ROW-PETERSON ARITHMETIC 5

Row - Peterson Arithmetic

BOOK FIVE

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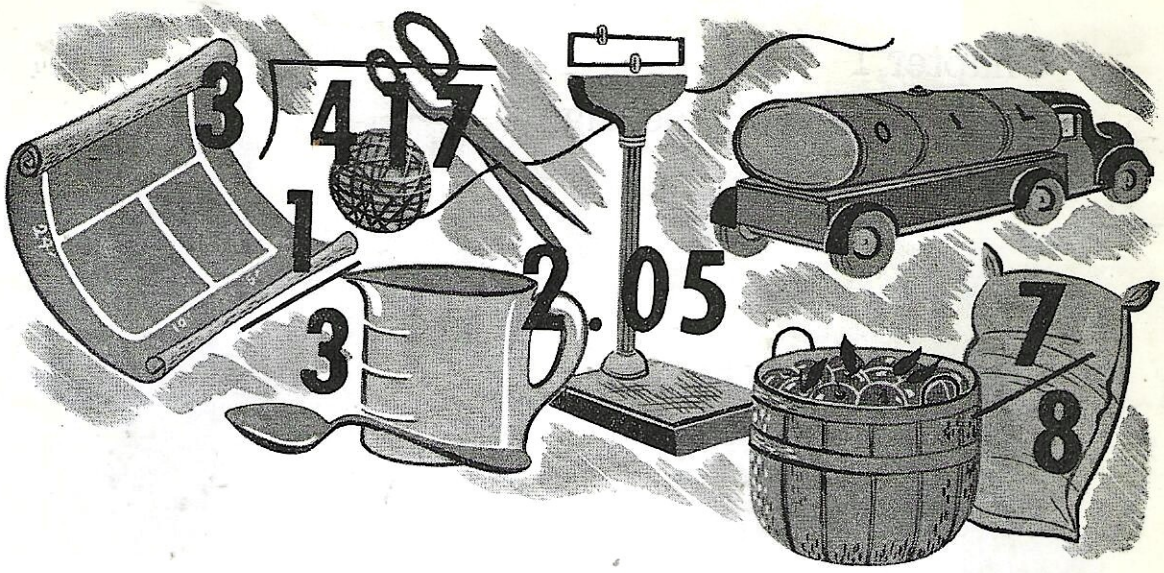

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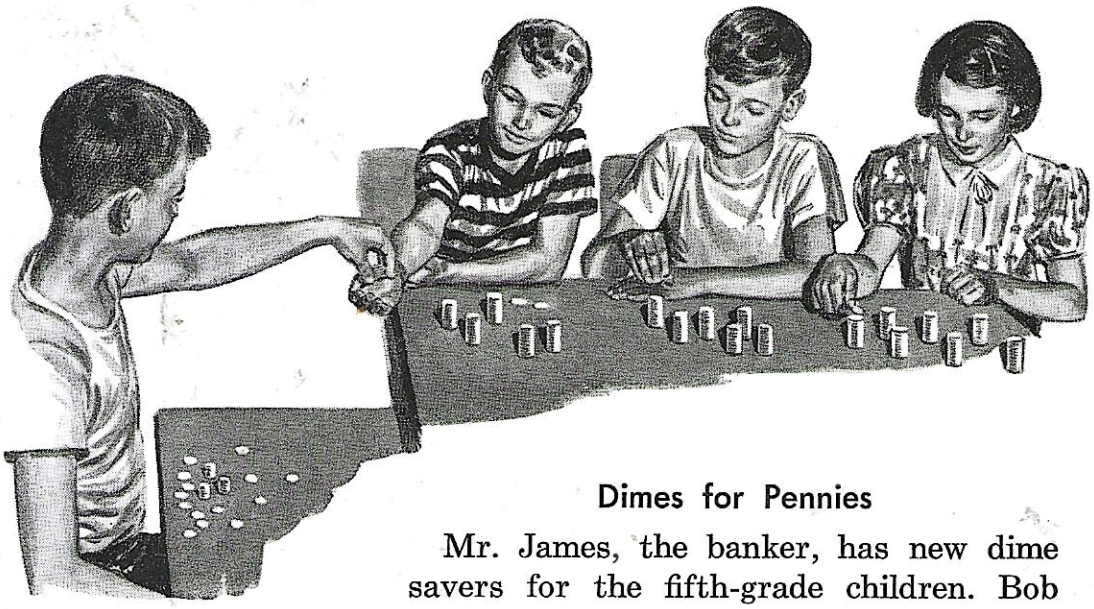
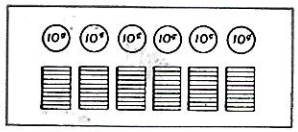
Dividing by Tens

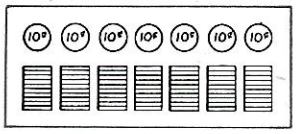


Dimes for Pennies

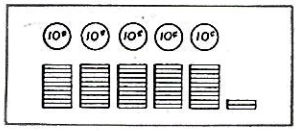
Mr. James, the banker, has new dime savers for the fifth-grade children. Bob is changing their pennies for dimes.



1. Bill has 60 pennies. He has them in piles of 10. How many tens does he have? How many dimes should Bob give him for them? How many tens are in 60?



2. Ann has 70 pennies. How many piles of 10 can she make? How many dimes should Bob give her? How many tens are in 70?



3. Jack has 52 pennies. How many piles of 10 does he have? How many pennies are left? How many dimes should he get? How many pennies will he have left?

[Test]

Reviewing Tens

We add tens the way we add ones.

Add:

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	
1.	30	90	44	25	48	90	97	38	99	78	(10) (18)
	40	60	65	81	75	88	40	62	11	96	

We subtract tens the way we subtract ones.

Subtract:

2.	90	170	97	168	70	180	93	175	100	103	(11) (20)
	50	80	57	88	55	95	46	97	67	76	(22)

We multiply tens the way we multiply ones.

Multiply:

3.	20	80	43	71	52	55	68	56	584	126	(33) (36)
	4	6	2	9	4	6	7	9	7	4	(37)

We divide tens the way we divide ones.

Divide:

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	
4.	$3\overline{)60}$	$9\overline{)450}$	$3\overline{)69}$	$6\overline{)426}$	$4\overline{)816}$	$9\overline{)765}$	$8\overline{)984}$	(53) (61) (62)

We multiply by tens the way we multiply by ones.

Multiply:

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	
5.	50	76	432	400	370	807	58	436	387	(40) to (43)
	40	60	40	60	80	75	39	55	28	

How do we divide by tens?

We divide by tens the way we divide by ones. But we must be careful to write each part of our answer in its proper place.

What Division Asks

1. What does the question $2\overline{)8}$ ask?

Back in the second or third grade we learned that $2\overline{)8}$ asks, *How many twos are in eight?*

To answer the question, we take a group of eight and arrange them in twos and count the twos.

We find there are four twos in eight. We answer, "Twos in eight, four. Four twos are eight."

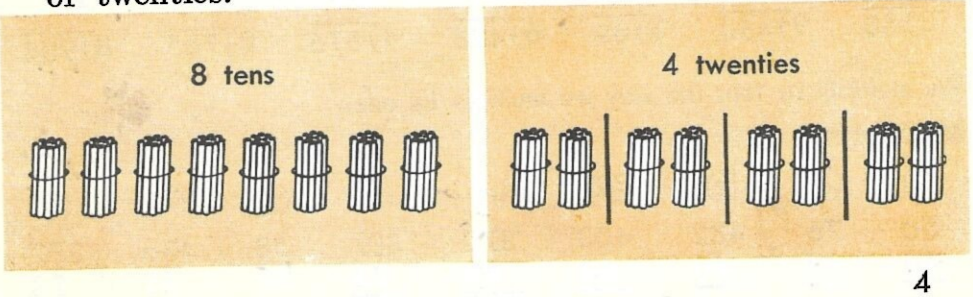
This is the way we write our answer:

$$\begin{array}{r} 4 \\ 2\overline{)8} \\ \underline{8} \end{array}$$

2. What does the question $20\overline{)80}$ ask?

It asks, *How many twenties are in eighty?*

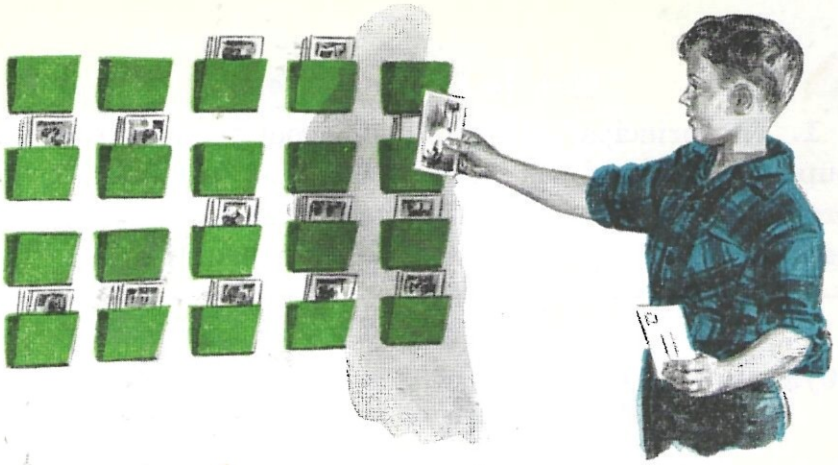
To answer the question, let us take a group of 8 tens, such as 8 bundles of toothpicks with 10 toothpicks in each bundle, and arrange them into groups of 2 tens, or twenties.



We find that there are 4 twenties in eighty. We write our answer like this:

$$\begin{array}{r} 4 \\ 20\overline{)80} \\ \underline{80} \end{array}$$

We divide by tens the way we divide by ones.



How We Divide by Tens

1. Tom wants to put 80 post cards into 20 pockets of the card rack. How many cards will he put in each pocket if he puts the same number in each of them.

To answer the question, we divide 80 by 20.

First, we decide where to start writing our answer. We think, "Twenties in eight, no." So we know that our answer will not be tens. Now we think, "Twenties in eighty, yes." So we prepare to write our answer in one's place just above 0 in 80.

$$20\overline{)80}$$

We still have the answer to find. To do this, we think, "Twos in eight, four," and write 4 in one's place above 0 in 80.

Last, we multiply 20 by 4 and draw a line.

$$\begin{array}{r} 4 \\ 20\overline{)80} \\ \underline{80} \end{array}$$

2. One hundred sixty Boy Scouts are going to march in the parade. The leaders plan to have them march in groups of 20. How many groups of Boy Scouts will be in the parade?

$$\begin{array}{r} 8 \\ 20\overline{)160} \\ \underline{160} \end{array}$$

How to Divide by Tens

1. The principal of the Park School thought that the pupils would need 4200 sheets of paper for their writing practice. He knew that the paper came 60 sheets in a package. How many packages did he need to get?

$$60\overline{)4200}$$

First, decide where to start writing the answer. Then think, "Sixes in 42, 7." Write 7 in its proper place. Why do we write 7 in ten's place? Why is 70 and not 7 the answer?

$$\begin{array}{r} 70 \\ 60\overline{)4200} \\ \underline{420} \\ 0 \end{array}$$

Hundreds and thousands are divided just as tens are divided, but we must write each part of the answer in its proper place.

2. Explain how these numbers were divided:

$$\begin{array}{r} 700 \\ 60\overline{)42000} \\ \underline{420} \\ 00 \end{array} \qquad \begin{array}{r} 80 \\ 80\overline{)6400} \\ \underline{640} \\ 0 \end{array} \qquad \begin{array}{r} 800 \\ 80\overline{)64000} \\ \underline{640} \\ 00 \end{array} \qquad \begin{array}{r} 900 \\ 90\overline{)81000} \\ \underline{810} \\ 00 \end{array} \qquad \begin{array}{r} 90 \\ 50\overline{)4500} \\ \underline{450} \\ 0 \end{array}$$

3. Jack has 180 sea shells. If he puts 30 shells into a box, how many boxes will he need?

4. The fifth-grade pupils are giving a play. They have 300 tickets to sell. If each of the 30 pupils takes the same number of tickets, how many will each take?

Divide:

	(*a*)	(*b*)	(*c*)	(*d*)	(*e*)
5.	$20\overline{)180}$	$30\overline{)210}$	$40\overline{)240}$	$50\overline{)400}$	$70\overline{)420}$
6.	$80\overline{)720}$	$80\overline{)320}$	$60\overline{)480}$	$20\overline{)140}$	$50\overline{)450}$
7.	$50\overline{)3500}$	$40\overline{)3600}$	$90\overline{)270}$	$90\overline{)54000}$	$80\overline{)32000}$

Dividing and Carrying

1. The boys are getting books from the public library. They are getting 20 books for each room at school, or 240 books in all. For how many rooms are they getting books?

$$\begin{array}{r} 12 \\ 20\overline{)240} \\ 20 \\ \hline 40 \\ 40 \\ \hline \end{array}$$

How do we know where to start writing the answer? How can we be sure the answer is right?

Check

$$\begin{array}{r} 12 \\ \times 20 \\ \hline 240 \end{array}$$

2. In the main reading room of the public library there are 1750 books. If they are placed 50 books on each shelf, how many shelves of books are there?

We decide where to start writing the answer: Fifties in 1, no. Fifties in 17, no. Fifties in 175, yes. The first figure in the answer is written over the 5 in 175, or in ten's place.

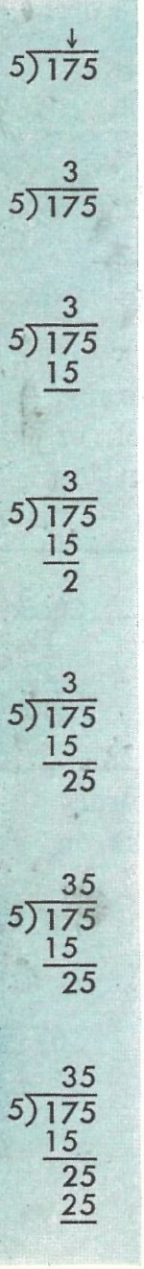
We think, "Fives in 17, 3." We write 3 in the answer, multiply, subtract, and bring down 0.

We think, "Fives in 25, 5." We write 5 and multiply.

There are 35 shelves of books.

$$\begin{array}{r} 35 \\ 50\overline{)1750} \\ 150 \\ \hline 250 \\ 250 \\ \hline \end{array}$$

Steps in Dividing



First Step

Decide where to start writing the answer.

Second Step

Divide: Fives in seventeen, three. Write 3 in ten's place.

Third Step

Multiply: Notice that the product is **not more** than the partial dividend above it.

Fourth Step

Subtract: Notice that the remainder is **less** than the divisor.

Fifth Step

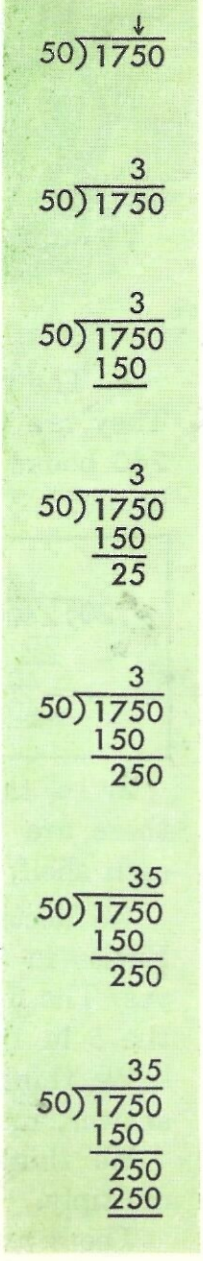
Bring down the next figure.

Now follow the same steps again. Begin with the second step.

Divide: Fives in twenty-five, five. Write 5 in one's place.

Multiply: Notice that the product is not more than the partial dividend above it.

Subtract: There is no remainder and there is nothing to **bring down.** The example is finished.



Practice

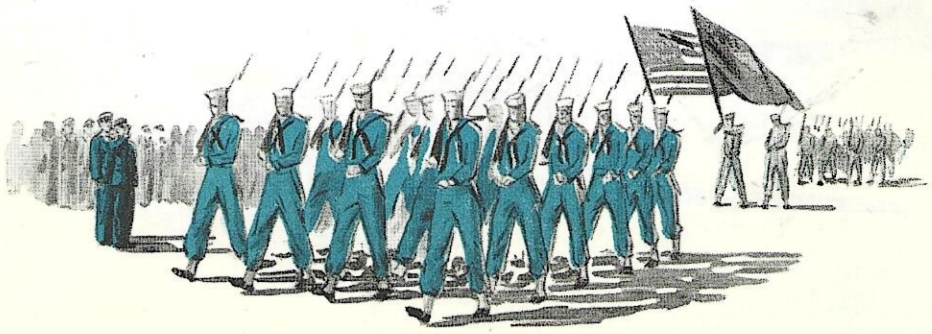
1. Notice how these examples are worked. Then copy each example and work it without looking at your book.

$$\begin{array}{r} 43 \\ 20\overline{)860} \\ \underline{80} \\ 60 \\ \underline{60} \end{array} \qquad \begin{array}{r} 69 \\ 20\overline{)1380} \\ \underline{120} \\ 180 \\ \underline{180} \end{array} \qquad \begin{array}{r} 619 \\ 20\overline{)12380} \\ \underline{120} \\ 38 \\ \underline{20} \\ 180 \\ \underline{180} \end{array} \qquad \begin{array}{r} 86 \\ 80\overline{)6880} \\ \underline{640} \\ 480 \\ \underline{480} \end{array} \qquad \begin{array}{r} 65 \\ 70\overline{)4550} \\ \underline{420} \\ 350 \\ \underline{350} \end{array}$$

Copy and divide:

	(*a*)	(*b*)	(*c*)	(*d*)	(*e*)
2.	$20\overline{)11920}$	$40\overline{)23120}$	$60\overline{)28080}$	$80\overline{)38240}$	$30\overline{)19860}$
3.	$50\overline{)32850}$	$70\overline{)20020}$	$90\overline{)25740}$	$20\overline{)17460}$	$40\overline{)33320}$
4.	$60\overline{)49980}$	$80\overline{)65840}$	$30\overline{)25590}$	$50\overline{)37650}$	$70\overline{)59010}$
5.	$90\overline{)74970}$	$20\overline{)13760}$	$40\overline{)18680}$	$60\overline{)23760}$	$80\overline{)31760}$
6.	$30\overline{)11610}$	$50\overline{)41850}$	$70\overline{)27790}$	$90\overline{)35730}$	$20\overline{)16940}$
7.	$40\overline{)15440}$	$60\overline{)17220}$	$80\overline{)22880}$	$70\overline{)51310}$	$90\overline{)67860}$

8. George and his father went to see the parade of sailors at Lakes Training Camp. There were 1680 sailors in the parade and 80 sailors in each company. How many companies of sailors were in the parade?



Problems

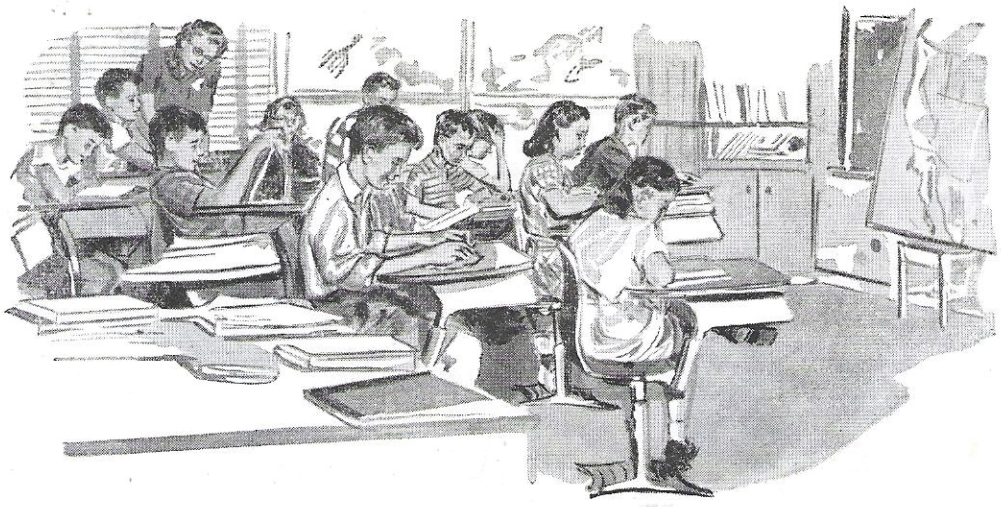
1. There are 360 pupils at Central School and an average of 30 pupils in each classroom. How many classrooms are in the school?

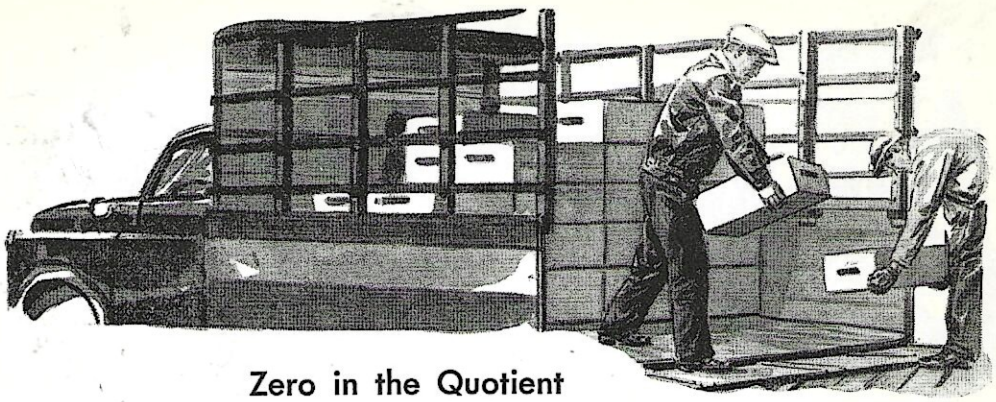
2. There are 30 pupils in the fifth-grade room. The principal has 960 tickets for them to sell. If he gives the same number of tickets to each pupil, how many will each pupil have to sell?

3. In the library of the Henley School there are 2400 books arranged on shelves. There are about 60 books on each shelf. How many shelves of books are there?

4. Miss Ward has 150 blotters for her class in handwriting. There are 30 pupils in her class. How many blotters can she give each pupil if she gives the same number to each?

5. Bess is reading her storybook at the rate of 20 pages an hour. In how many hours can she read the 240 pages in her book?





Zero in the Quotient

1. A large produce store bought 6240 dozen eggs. The eggs came in cases of 30 dozen each. How many cases of eggs were there?

First, decide where to start writing the answer.

Next, divide the hundreds, multiply, subtract, and bring down the next figure.

Now divide the tens: Thirties in 24, no. To hold the place in the answer above the 4 (ten's place), we write 0, and bring down the next figure.

Last, divide 240 (ones) by 30.

Our answer is 208 cases.

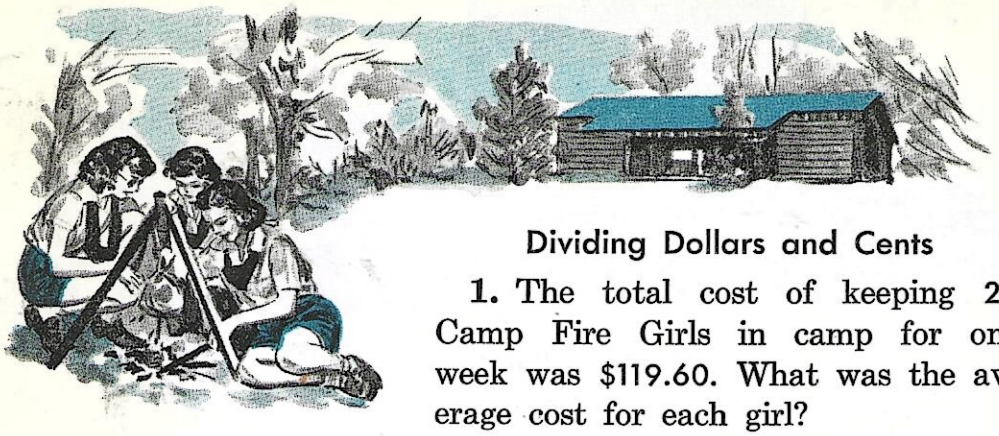
$$\begin{array}{r} 20 \\ 30\overline{)6240} \\ \underline{60} \\ 24 \end{array} \qquad \begin{array}{r} 208 \\ 30\overline{)6240} \\ \underline{60} \\ 240 \\ \underline{240} \end{array}$$

2. Notice how we divide in these examples:

$$\begin{array}{r} 306 \\ 70\overline{)21420} \\ \underline{210} \\ 420 \\ \underline{420} \end{array} \qquad \begin{array}{r} 507 \\ 90\overline{)45630} \\ \underline{450} \\ 630 \\ \underline{630} \end{array} \qquad \begin{array}{r} 806 \\ 60\overline{)48360} \\ \underline{480} \\ 360 \\ \underline{360} \end{array} \qquad \begin{array}{r} 706 \\ 40\overline{)28240} \\ \underline{280} \\ 240 \\ \underline{240} \end{array}$$

Copy and divide:

	(a)	(b)	(c)	(d)	(e)
3.	$20\overline{)12180}$	$40\overline{)12280}$	$60\overline{)12480}$	$80\overline{)16720}$	$30\overline{)27240}$
4.	$50\overline{)10350}$	$70\overline{)14420}$	$90\overline{)18720}$	$20\overline{)14180}$	$40\overline{)24320}$
5.	$60\overline{)54180}$	$80\overline{)56400}$	$30\overline{)21150}$	$70\overline{)42210}$	$90\overline{)63180}$



Dividing Dollars and Cents

1. The total cost of keeping 20 Camp Fire Girls in camp for one week was $119.60. What was the average cost for each girl?

```
      $5.98
20)$119.60
   100
   ----
    19 6
    18 0
    ----
     1 60
     1 60
     ----
```

We divide $119.60 by 20 in exactly the same way as we would divide 11960 by 20, **except** that we are careful to write each part of our answer in its proper place and to put the point in our answer above the point in the dividend.

2. Notice how we divide in these examples:

```
      $5.57          $5.63          $6.49          $8.64
50)$278.50     60)$337.80     70)$454.30     40)$345.60
   250            300            420            320
   ----           ----           ----           ----
    28 5           37 8           34 3           25 6
    25 0           36 0           28 0           24 0
    ----           ----           ----           ----
     3 50           1 80           6 30           1 60
     3 50           1 80           6 30           1 60
     ----           ----           ----           ----
```

Copy and divide:

	(*a*)	(*b*)	(*c*)	(*d*)
3.	20)$193.20	40)$112.80	60)$303.60	80)$598.40
4.	70)$444.50	50)$105.50	30)$189.90	20)$175.40
5.	60)$436.80	80)$657.60	70)$516.60	90)$815.40

Dividing Dollars and Cents

1. The 40 members of the Good Citizens Club ordered badges. The 40 badges cost \$18.00. How much did each badge cost?

We divide \$18.00 by 40 the way we divide 1800 by 40. But we must be sure to write each part of our answer in its proper place and to put the point in its proper place. Where do we put the point? Is \$.45 a reasonable answer?

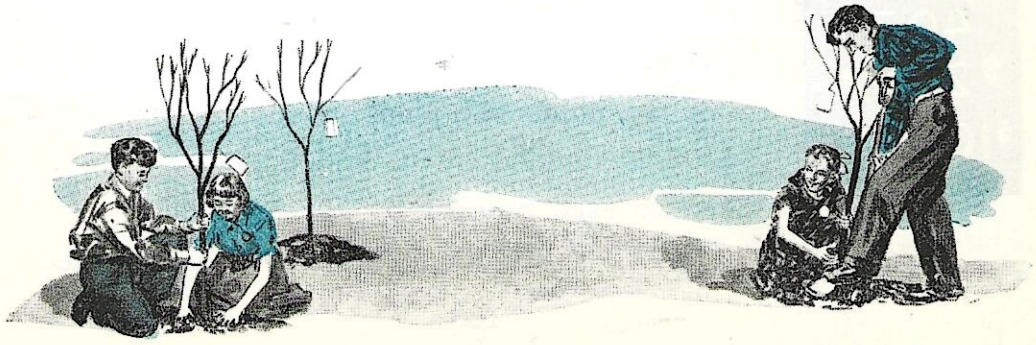
$$\begin{array}{r} \$.45 \\ 40\overline{)\$18.00} \\ 160 \\ \hline 200 \\ 200 \\ \hline \end{array}$$

2. Notice how we divide in these examples:

$$\begin{array}{r} \$.56 \\ 70\overline{)\$39.20} \\ 350 \\ \hline 420 \\ 420 \\ \hline \end{array} \qquad \begin{array}{r} \$.48 \\ 90\overline{)\$43.20} \\ 360 \\ \hline 720 \\ 720 \\ \hline \end{array} \qquad \begin{array}{r} \$.76 \\ 30\overline{)\$22.80} \\ 210 \\ \hline 180 \\ 180 \\ \hline \end{array} \qquad \begin{array}{r} \$.97 \\ 60\overline{)\$58.20} \\ 540 \\ \hline 420 \\ 420 \\ \hline \end{array}$$

Divide and check:

	(*a*)	(*b*)	(*c*)	(*d*)
3.	$20\overline{)\$19.60}$	$40\overline{)\$22.80}$	$60\overline{)\$22.20}$	$80\overline{)\$45.60}$
4.	$50\overline{)\$37.50}$	$70\overline{)\$46.90}$	$90\overline{)\$88.20}$	$20\overline{)\$9.60}$
5.	$60\overline{)\$27.60}$	$80\overline{)\$66.40}$	$30\overline{)\$29.40}$	$50\overline{)\$24.00}$



Dividing by 10

Study these examples:

$$\begin{array}{r} 6 \\ 10\overline{)60} \\ \underline{60} \\ \end{array} \qquad \begin{array}{r} 60 \\ 10\overline{)600} \\ \underline{60} \\ 0 \end{array} \qquad \begin{array}{r} 27 \\ 10\overline{)270} \\ \underline{20} \\ 70 \\ \underline{70} \end{array} \qquad \begin{array}{r} 270 \\ 10\overline{)2700} \\ \underline{20} \\ 70 \\ \underline{70} \\ 0 \end{array} \qquad \begin{array}{r} 8075 \\ 10\overline{)80750} \\ \underline{80} \\ 75 \\ \underline{70} \\ 50 \\ \underline{50} \end{array}$$

$$\begin{array}{r} \$.60 \\ 10\overline{)\$6.00} \\ \underline{60} \\ 0 \end{array} \qquad \begin{array}{r} \$.06 \\ 10\overline{)\$.60} \\ \underline{60} \end{array} \qquad \begin{array}{r} \$2.70 \\ 10\overline{)\$27.00} \\ \underline{20} \\ 70 \\ \underline{70} \\ 0 \end{array} \qquad \begin{array}{r} \$2.75 \\ 10\overline{)\$27.50} \\ \underline{20} \\ 75 \\ \underline{70} \\ 50 \\ \underline{50} \end{array} \qquad \begin{array}{r} \$80.75 \\ 10\overline{)\$807.50} \\ \underline{80} \\ 75 \\ \underline{70} \\ 50 \\ \underline{50} \end{array}$$

"I know a short cut in dividing by tens," said Ward. "Drop the last zero in the number you want to divide, and you have the answer."

Sixty divided by 10 is 6. Sixty is 6 tens.

Six hundred divided by 10 is 60. Six hundred is 60 tens.

270 divided by 10 is 27.

3850 divided by 10 is 385.

4070 divided by 10 is 407.

This is *tricky*. You cut off the last zero and move the point one place to the left.

$108.90 divided by 10 is $10.89.

Divide each number by 10:

750 8600 $9.70 $68.50 89070 7060 $70.60

Review Practice

1. Add:

(a)	(b)	(c)	(d)	(e)	(f)
4876	2580	3692	5467	$37.68	$128.60
6073	1419	2538	1788	42.50	216.37
5192	7265	4477	3686	9.75	190.74
1648	5038	1008	2508	23.40	208.43

2. Subtract:

7083	6704	7890	8203	$78.60	$350.00
4625	2063	2897	5648	43.75	238.65

3. Multiply:

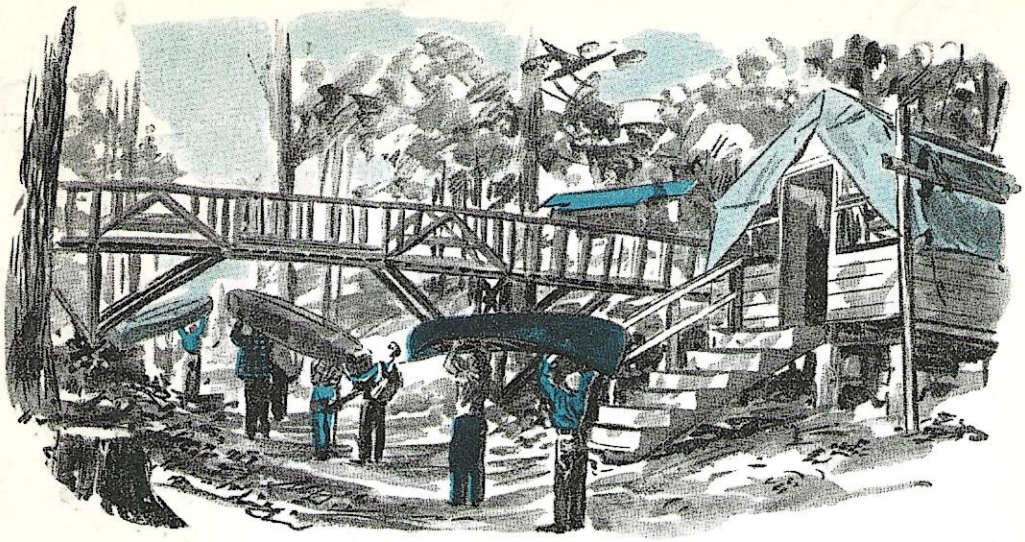
(a)	(b)	(c)	(d)	(e)	(f)	(g)
457	862	108	590	$7.65	$8.67	$5.86
15	28	74	87	73	96	86

Divide:

	(a)	(b)	(c)	(d)	(e)
4.	$2\overline{)10076}$	$3\overline{)1371}$	$4\overline{)20704}$	$5\overline{)4235}$	$6\overline{)47118}$
5.	$7\overline{)3976}$	$8\overline{)26072}$	$9\overline{)8865}$	$20\overline{)14120}$	$30\overline{)16140}$
6.	$40\overline{)\$332.80}$	$50\overline{)\$34.50}$	$60\overline{)30360}$	$70\overline{)20650}$	$90\overline{)\$77.40}$

Find:

	(a)	(b)	(c)	(d)
7.	$\frac{2}{3}$ of 228	$\frac{5}{8}$ of 520	$\frac{4}{9}$ of $7.65	$\frac{1}{7}$ of $5.25
8.	$\frac{3}{4}$ of 268	$\frac{1}{6}$ of 498	$\frac{3}{5}$ of $5.80	$\frac{7}{8}$ of $10.00
9.	$\frac{5}{9}$ of 405	$\frac{2}{9}$ of 297	$\frac{4}{7}$ of $2.10	$\frac{4}{5}$ of $15.95
10.	$\frac{3}{8}$ of 368	$\frac{6}{7}$ of 294	$\frac{5}{6}$ of $6.42	$\frac{7}{9}$ of $20.70



The Scout Camp

1. The Board of Directors of the Boy Scouts in Belton decided to buy and build a new camp for the Scouts in their city. They bought 20 acres of land along a stream in the hills. The total cost of the land was $2500. How much did the land cost per acre?

2. The Board had a lodge built, 2 headquarters huts, a kitchen, a fence around the land, and a swimming pool. The Board had to pay the following amounts:

For the lodge	$1173.80
For the huts	416.15
For the kitchen	672.35
For the fence	48.00
For the pool	375.00

How much did the Board pay for the improvements?

3. The Board bought $314.70 worth of new camp equipment. Find how much they spent for all—the land, the improvements, and the new equipment.

4. The Board of Directors had $1500 in the treasury. The Civic Club of the city gave them $1000 to use in buying and building the new camp. How much did the Board then have to spend?

5. If the Board needed $5500, how much money did they have to raise besides the $2500 they already had?

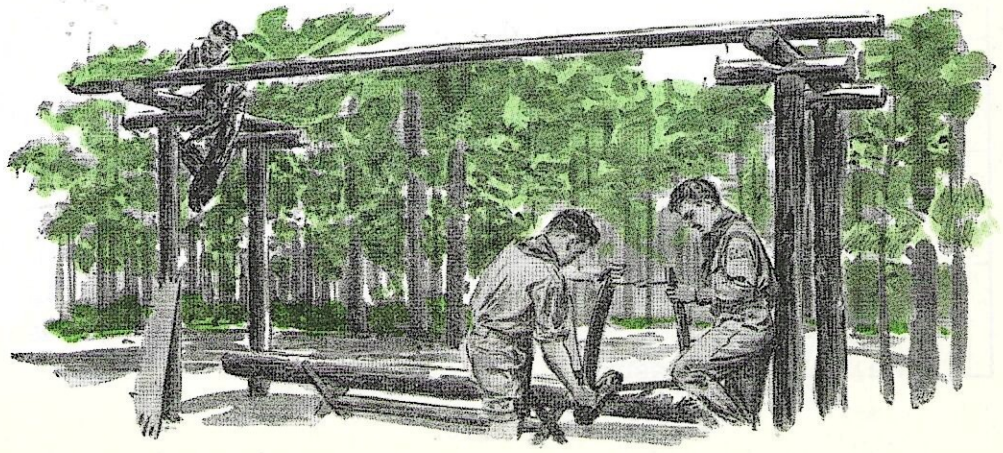
6. The Board received $463.87 in donations last year. If the Board were to receive the same amount each year for the next 5 years, how much would the Board receive?

$$\begin{array}{r} \$\ 463.87 \\ \times\quad 5 \\ \hline \$2319.35 \end{array}$$

7. The Board found that it costs about 68¢ a day to keep a Boy Scout in camp. How much does it cost to keep one boy in camp for 14 days?

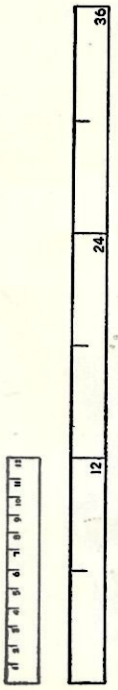
8. How much would it cost to keep 60 boys in camp for the 14 days?

9. Last summer the Boy Scouts built a memorial gateway at the entrance to the camp. They did the work themselves, but they had to pay $46.80 for materials. The 60 boys shared the expense equally. How much was each boy's share?



Chapter 10
Weights and Measures

Measures



It is very important for us to know about measures. Can you tell why? Try answering these questions:

What time is it? How long is it until Christmas?

How tall are you? How much do you weigh?

How long is your book? How wide is your room?

How far is it to the next town? How far can you jump?

If you have a quart of milk, to how many people can you serve a glass of milk?

How many nickels have the same value as a dollar?

Can you answer any of these questions without knowing something about measures?

Each measure is called a **unit**. Inch, yard, dozen, and quart are units of measure. There are both large and small units for measuring each sort of thing. The inch, foot, and yard are units of different sizes for measuring length. The unit we use depends on just what it is we want to measure.

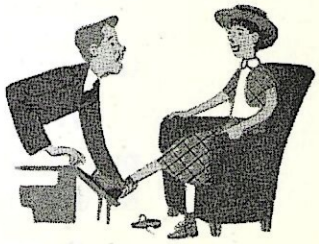
Reviewing Weights and Measures

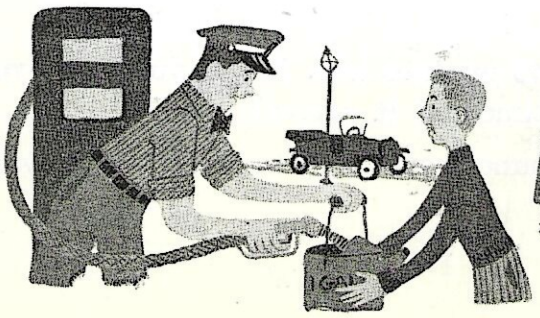
Complete the following sentences:

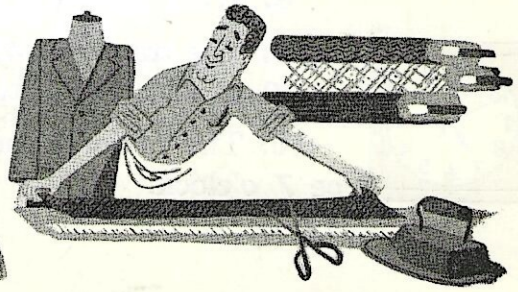
1. A peck is one of the *four* equal parts of a bushel.
2. A quart is _____ _____ of a peck.
3. A quart is _____ _____ of a gallon.
4. There are *1760* yards in a mile. There are _____ times as many feet in a mile, or _____ feet.
5. There are _____ pints in a quart, and there are _____ times as many in a gallon. In one gallon there are _____ pints.
6. There are _____ inches in a yard.

Find the answers:

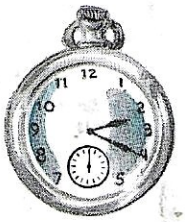
7. How many quarts are in 5 bushels?
8. How many inches are in 4 yards?
9. How many feet are in 300 yards?
10. How many yards are in 288 feet?
11. How many yards are in $\frac{1}{4}$ of a mile?
12. How many feet are in $\frac{1}{3}$ of a mile?
13. How many pounds are in 17 tons?
14. How many pounds are in 560 ounces?
15. How many pecks are in 78 bushels?
16. How many gallons are in 552 quarts?







Time



1. What time does the watch show?
We write this time 2:20. We say it: **two twenty.**

2. If we write 2:20 A.M., what does it mean?

3. What time does the alarm clock show?
We write this time 8:50. We say it: **eight fifty.**

4. If we write 8:50 P.M., what does it mean?

The extra hand on this watch is the **second** hand. It moves around its circle in one minute. Each little mark on this circle measures one second. How many seconds are in a minute?

The alarm clock has an extra hand, too. This hand does not move by itself. What numbers are shown around its circle? What is it for?

ALARM SET

5. The program began at 2:00 P.M. It was finished at 4:15 P.M. How long was the program?

6. We started on the picnic at 9:30 A.M. and got back home at 4:20 P.M. How long were we gone?

Count the hours and minutes until noon. Then count those after noon. Add them.

7. It should take 5 hours to roast our turkey. We put it in the oven at 9:15 A.M. When should the turkey be done?

8. What part of a minute is 1 second? 30 seconds?

9. The train was 45 minutes late. It was due to arrive at 10:45 A.M. What time did it arrive?

10. The radio announcer said, "In ____ seconds it will be 7 o'clock.

Some Ways of Counting Time

A **decade** is ten. A **score** is twenty. A **century** is one hundred.

1. What does this mean: *It happened a decade ago?*

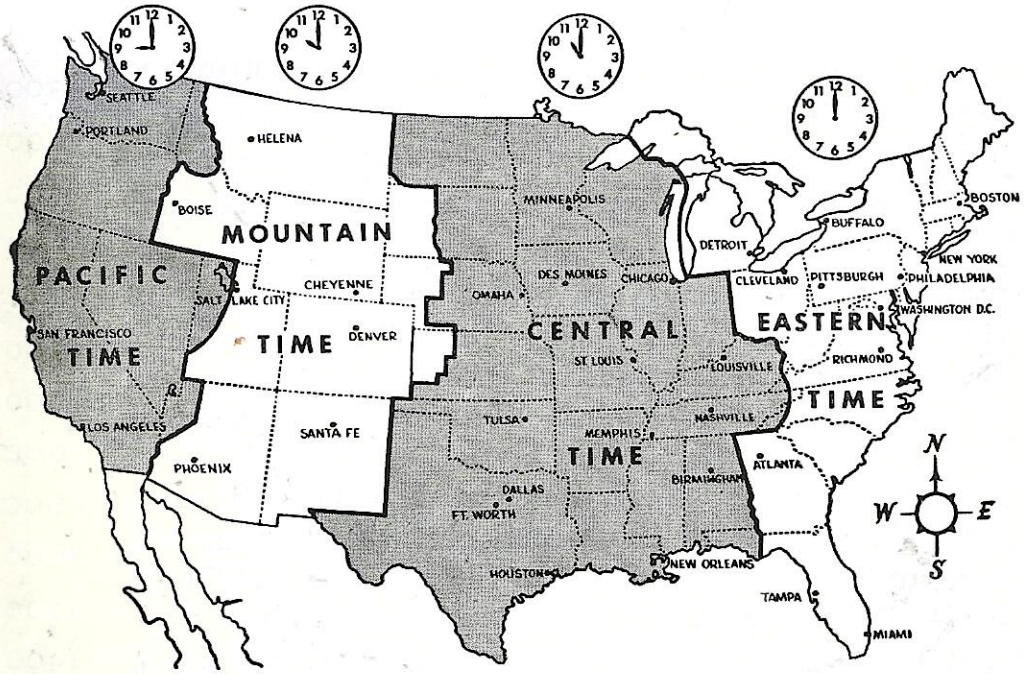
2. How old is a person who is three score and ten?

Our years are counted from the birth of Christ. We write **B.C.** after any year before that event, as 635 B.C. The letters mean "before Christ." Any year since the birth of Christ is called **A.D.**, meaning "in the year of our Lord" (anno Domini). When no letters follow a year, it means A.D.

The first century A.D. was the first hundred years after Christ's birth. The second century was from 101 A.D. to 200 A.D. The fifteenth century was from 1401 to 1500. We live in the **twentieth** century.

3. In 1933 the city of Chicago had a big fair which was called *A Century of Progress.* What do you think the fair was meant to show?

4. The first Thanksgiving was observed in Plymouth Colony by the Pilgrims on December 13, 1621. In 1789 President Washington set aside November 26 as a national Thanksgiving Day. In 1862 President Lincoln proclaimed the last Thursday in November as a national holiday. In what century was each of these dates?



Time Zones

Jim and his father live in Los Angeles. They are going to listen to the broadcast of the Army-Navy football game.

"We had better turn on the radio. It's almost time for the game to start," said Mr. West.

"But it's not 10 o'clock yet," said Jim, "and the game doesn't start until 1:15."

"I know," said Mr. West, "but the game starts at 1:15 New York time and 10:15 our time."

When it is 12 o'clock noon in Los Angeles, it is 3 o'clock in the afternoon in New York, and when it is 12 o'clock noon in New York, it is 9 o'clock in the morning in Los Angeles.

Look at the map. It shows how the United States is divided into **time zones.**

1. How many time zones are there?

2. What are the time zones called?

3. The time in any one zone is exactly the same, but the time changes when we go from one zone to another. As we go east from one zone to another, we move our watches **forward** one hour. How do we move our watches when we go west from one zone to another?

4. James lives in Denver. He went with his father to Washington, D.C. He had to set his watch in Washington. What is the difference in time between these places?

5. Jack lives in Houston, Texas. The President will speak over the radio from Washington, D.C., at 9 P.M., Eastern Standard Time. At what time will Jack hear his speech, Central Standard Time?

6. When it is midnight in Chicago, what time is it in Seattle? When it is 9 P.M. in Seattle, what time is it in Chicago? When it is 12 noon in Seattle, what time is it in Chicago?

7. When the children are going to school (9 A.M.) in Los Angeles, what are the children in New York doing? What is the time in New York?

8. An airplane leaving New York at 3 A.M., Eastern Standard Time, requires 4 hours to fly to Chicago. When will it arrive in Chicago, Central Standard Time?

9. The Rose Bowl game was broadcast from California, starting at 3:30 P.M., Pacific Time. What time did the Chicago stations begin their broadcasts?

The Table of Time

The units most often used for measuring time are made into a table here. The abbreviations are also given. The table should help you to remember how units of time are related.

60 seconds (sec.)	*= 1 minute (min.)*
60 minutes	*= 1 hour (hr.)*
24 hours	*= 1 day (da.)*
7 days	*= 1 week (wk.)*
52 weeks, 365 days, or 12 months (mo.)	*= 1 year (yr.)*
366 days	*= 1 leap year*
10 years	*= 1 decade*
100 years	*= 1 century*

1. Mary can iron 4 shirts in an hour. About how long does it take her to iron one shirt?

2. Mr. Allen earns 85¢ an hour. He works 8 hours a day, 7 days a week. How much does he earn in a day? in a week? in a year?

3. Roy earns $175 a month. At this rate how much does he earn in a year?

4. It costs 10¢ to ride on the bus. Every day for one week Ann went to town and back on the bus. How much did she pay for bus fare for those trips?

5. George Washington was born in 1732. How many years ago was that? About how many centuries?

6. Say the right number for each blank:

a. 3 days = ___ hr. *b.* 6 wk. = ___ days *c.* $\frac{1}{4}$ hr. = ___ min.

d. $\frac{1}{2}$ yr. = ___ mo. *e.* 5 min. = ___ sec. *f.* $\frac{1}{3}$ hr. = ___ min.

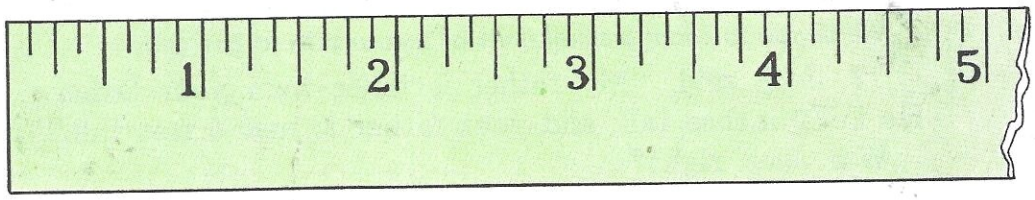
g. 28 days = ___ wk. *h.* 1 yr. 8 mo. = ___ mo.

Length

1. With your ruler, measure the length of this page. What unit of measure do you use?

2. What unit would you use to measure the width of your desk? the length of your room? Measure each one.

3. Draw a line on a piece of paper. Measure it. Did your line come exactly to an inch mark? If not, call its length the number of inches to which it comes **nearest**. The end of the line may be a little before or a little beyond an inch mark.

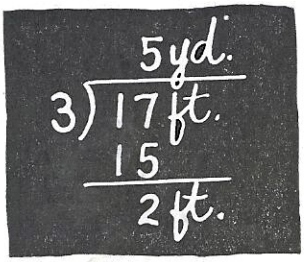


4. How many inches long is the line above? Look for the inch mark nearest the end of the line.

5. Look at the half-inch mark. Is the length of the line nearer $4\frac{1}{2}$ inches or 5 inches? Is it more accurate to say that the line is about $4\frac{1}{2}$ inches long than it is to say that the line is about 5 inches long?

6. Will your measurement be even more accurate if you measure with fourths of an inch? What will the measurement be to fourths of an inch? to eighths of an inch?

7. Measure the width of the room to the nearest yard. Now measure it in feet. Which measurement is more accurate?



Changing Measures of Length

1. How many inches are 3 feet?

2. How many feet are 36 inches?

3. How many feet are 5 yards?

4. How many yards are 12 feet?

5. Do we multiply or divide to change a measurement to a larger unit? to a smaller unit?

6. When we measure a length, will we have a larger number of units if we use a small unit or a large unit of measure?

We multiply to change large units of measure to smaller units.
We divide to change small units of measure to larger units.

7. Jack said, "My father is taller than your father. He is 72 inches tall, and your father is just 6 feet tall."
Was Jack right?
To change 72 inches to feet, we divide 72 by 12.
To change 6 feet to inches, we multiply 6 by 12.

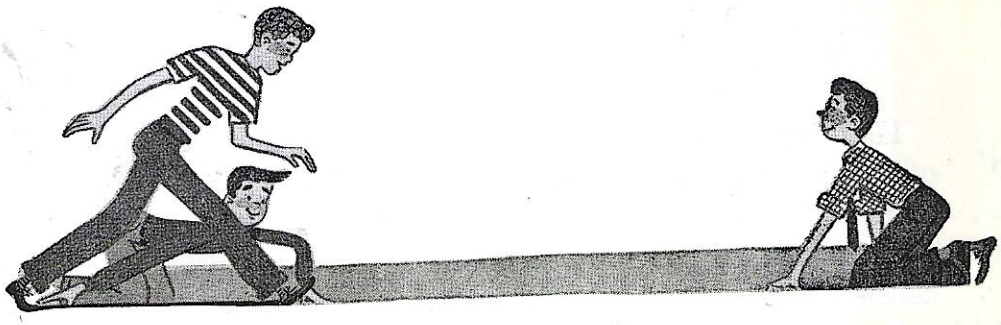
8. Jim is 4 feet 3 inches tall. What is his height in inches?

$$\begin{array}{r} 12 \\ \times 4 \\ \hline 48 \\ +3 \\ \hline 51 \end{array}$$

There are 12 inches in 1 foot; so in 4 feet there are 4 × 12 or 48 inches. But Jim is 3 inches more than 4 feet; so we add 3 inches to 48 inches.
Jim is 51 inches tall.

9. Change 17 feet to yards. Will there be any feet left over? 17 feet = ____ yards and ____ feet.

10. Change 150 inches to feet. Will there be any inches left over? 150 inches = ____ feet and ____ inches.



Estimating Length

With practice you will be surprised to learn how well you can **estimate** length.

1. Draw a line that you think is an inch long. Measure it. Was your estimate close to the right length?

2. Try 2 inches; 3 inches; 6 inches. Measure each one to see how close your estimate was to the measurement.

3. On the board draw a line that is a foot long. Measure it.

4. Estimate a yard of string in this way: With your left hand hold one end of the string at the end of your nose. With your right hand extend the string as far as you can stretch your arm. Hold this length and measure it with a yardstick. Is your reach long enough so that you can use it to estimate a yard?

5. You can estimate length on the floor by your step. We call this "stepping off" the length. With one heel against the wall take a long step. Hold it while someone measures this step. Is it nearly a yard long? Could you estimate a yard in this way?

Start with one heel against the wall. Stride across the room with long steps. Count your steps to estimate the width of the room. Measure the width with a yardstick. How was your estimate?

Longer Distances

Have some boy whose stride is about a yard long step off $5\frac{1}{2}$ yards. Another boy should make a mark on the floor at the end of each step. Measure the distance with a yardstick to see if it is about right. This distance is called a **rod.**

Count or measure the number of feet in this distance. Did you get $16\frac{1}{2}$ feet?

$5\frac{1}{2}$ yd. or $16\frac{1}{2}$ ft. = 1 rod (rd.)

This will help you to get in mind the length of a rod:

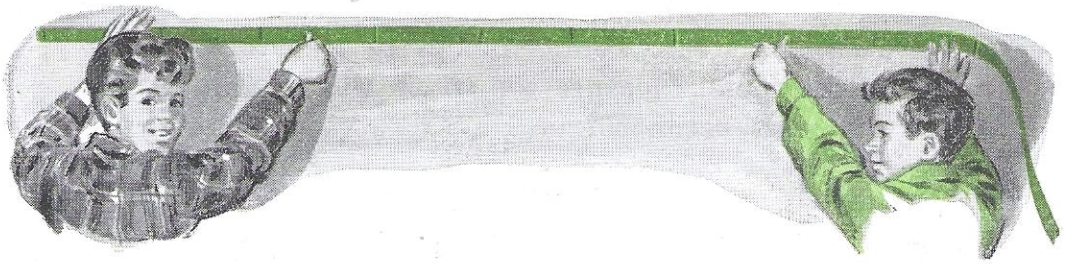
Cut strips of paper 2 inches wide. Paste enough strips together to make one strip that measures $5\frac{1}{2}$ yards. Make heavy marks across it to show each yard. Make marks of some other color to show each foot. Then fasten the strip on the wall where you will see it often.

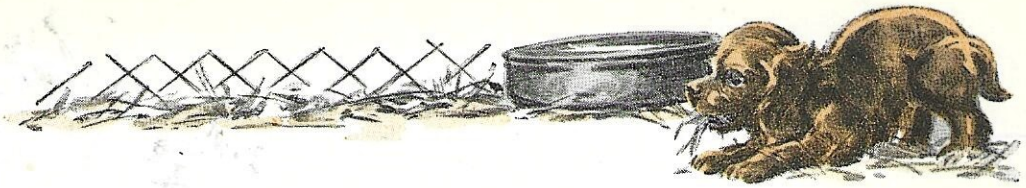
The **mile** is our longest unit of length. Locate some place that is about a mile from your home. When you need an idea of a mile, you can think of this distance.

There are 5280 feet in a mile (mi.). There are 320 rods in a mile.

1. The tank of Mr. Allen's car holds 16 gallons of gasoline. He can travel 18 miles on a gallon of gasoline. About what distance can he go on a tank of gasoline?

2. Suppose that Mr. Allen knows that the tank is about one fourth full. Can he safely make a 50-mile trip without buying more gasoline?

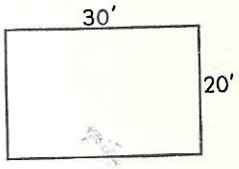




How Big Can Skippie's Pen Be?

Jack must make a pen for his new puppy. He has measured the place for the pen and found that it could be 30 ft. long and 20 ft. wide. How many feet of wire will he need to go around the pen?

Jack drew a picture of his pen. Its shape was a **rectangle**. He wrote the **dimensions** on his drawing. That is, he wrote the length on one side and the width on one end. He needs to find the distance around the pen. This is the **perimeter.**



1. To find how many feet of wire to buy, Jack needs to know how many feet it will be around the pen. To find this distance, he must add the lengths of the four sides. How many feet will it be around the pen? What is the perimeter of the rectangle? How many feet of wire will Jack need?

2. Could Jack have added 30 ft. and 20 ft. and then multiplied by 2? Why?

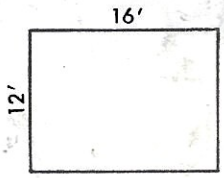
3. Draw a rectangle that is 4 in. long and 3 in. wide. Find its perimeter.

4. What is the perimeter of a rectangle that is 15 rd. long and 12 rd. wide?

5. The girls wanted to put new crepe paper around the window box. To find how much paper to cut, they measured the dimensions of the box. It was a rectangle 4 ft. long and 1 ft. wide. What was the perimeter of the box? How many feet of paper did they need?

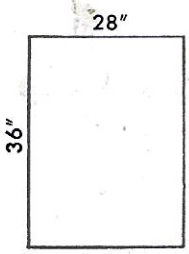
$$\begin{array}{r} 30 \text{ ft.} \\ 20 \text{ ft.} \\ \hline 50 \text{ ft.} \\ \times 2 \\ \hline 100 \text{ ft.} \end{array}$$

Finding Perimeters



1. What is the perimeter of this rectangle?

The rectangle is 16 ft. long and 12 ft. wide. We may say that it is 16 ft. by 12 ft. We may write the dimensions: 16′ by 12′, or 16′ × 12′. That little mark after a number means **feet.**



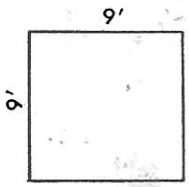
2. Find the perimeter of rectangles whose dimensions are:

15 ft. by 9 ft. 27′ by 19′ 18′ × 15′ 14′ × 16′

3. Two little marks after a number mean **inches**: 36 inches may be written 36″.

Find the perimeter of the rectangles with these dimensions:

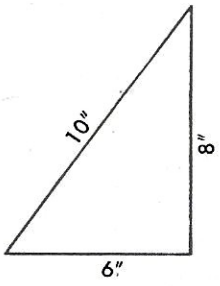
36″ × 28″ 30″ × 24″ 22″ × 17″ 16″ × 18″



4. This is a **square.** All sides of a square are the same length. This square is 9′ by 9′. What is its perimeter?

We can find the perimeter of this square by multiplying 9 by 4. Why?

5. When we say that a square is 5 inches on a side, we mean that its dimensions are 5″ × 5″. What is the perimeter of this square?

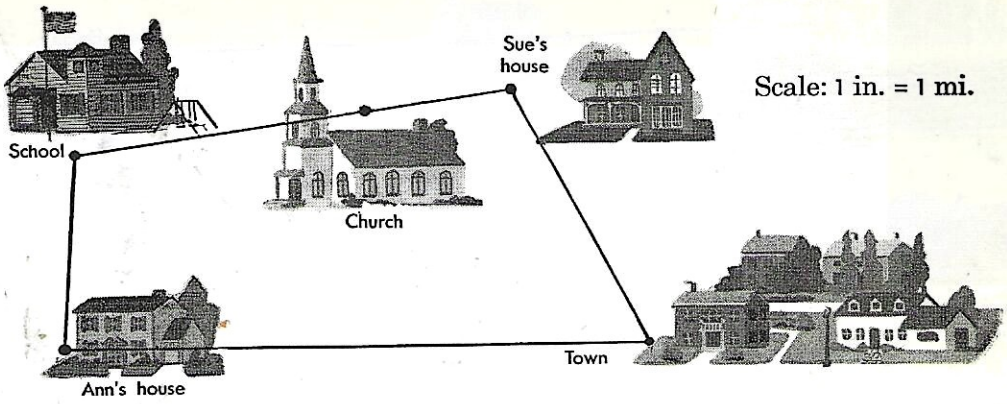


6. What is the perimeter of a square that is 19″ on a side? one that is 36″ on a side?

7. A **triangle** has three sides. To find the perimeter of a triangle, we add the lengths of the three sides.

Find the perimeter of this triangle.

8. The picture of a rectangle, a square, or a triangle is called a **figure.**



Making a Map

Ann and Sue made a map to send to their pen pals. They let 1 inch on the map stand for 1 mile.

1. Measure the line from Ann's house to the school. This line is 1 inch long; so Ann lives 1 mile from school.

2. Measure the line from Sue's house to school. How far does Sue live from school?

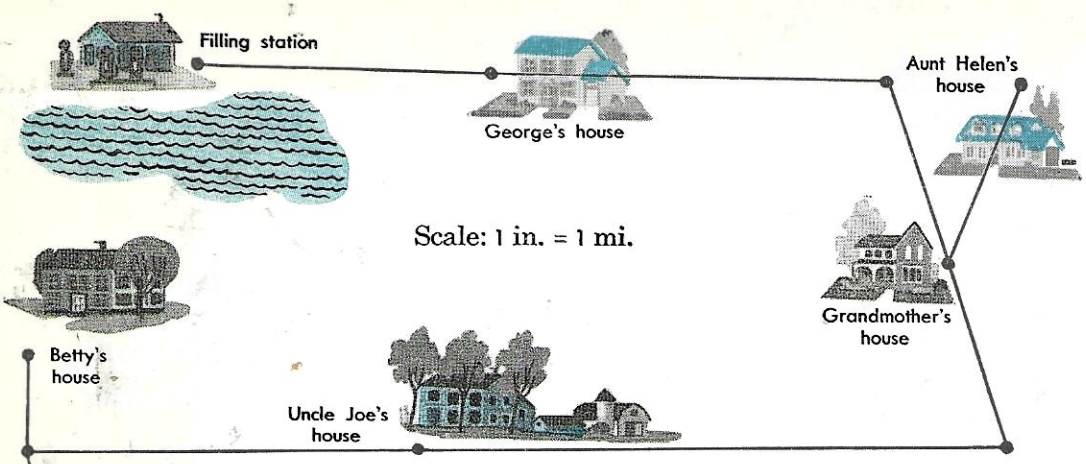
3. How far does Sue live from the church? How far does Ann live from the church?

4. Measure the line from Sue's house to town. This line is $1\frac{1}{2}$ inches long; so the distance must be $1\frac{1}{2}$ miles.

5. How far does Ann live from town?

6. When Ann goes to visit Sue, she goes around by the school. How far must she go?

This little map is the same shape as the real place, but it is much smaller in size. A **certain length** on the map shows a **given distance.** This makes our map a **scale drawing.** The distances are measured by the **scale.** The scale here is: **1 in. = 1 mi.** We must know the scale in order to find what distances the lines mean. Such a map is **drawn to scale.**



Bill Visits Uncle Joe

Bill went to visit his Uncle Joe, who lives on a farm in Iowa. Bill made a scale drawing to send to Tom. With it, Tom could get a better idea of the places Bill wrote about.

1. What scale did Bill use for his drawing?

2. How far does Uncle Joe live from town? from Bill's cousin George? from Bill's grandmother?

3. What is the distance from Grandmother's to Aunt Helen's? from Grandmother's to George's?

4. One morning George walked to the filling station. How far did he walk?

5. On Sunday Grandmother invited all the relatives to dinner. How far did each family have to go to reach her home?

6. How much farther did Betty's family have to go than any of the other families?

7. Uncle Joe needs gasoline. Will it be a shorter trip for him to go to the filling station for it or to go to town for it? How much shorter?

12 inches (in.)	= 1 foot (ft.)	$16\frac{1}{2}$ feet	= 1 rod
3 feet	= 1 yard (yd.)	5280 feet	= 1 mile (mi.)
$5\frac{1}{2}$ yards	= 1 rod (rd.)	320 rods	= 1 mile

Measuring Length and Distance

You will use the answers to some of these questions to find the answers to others. Check to be sure each one is right.

1. Nancy is to make the prize ribbons for the flower show. Each ribbon is to be 6″ long. How many can she make from a yard of ribbon?

2. Nancy needs 18 of the ribbons. How many yards of ribbon should she buy?

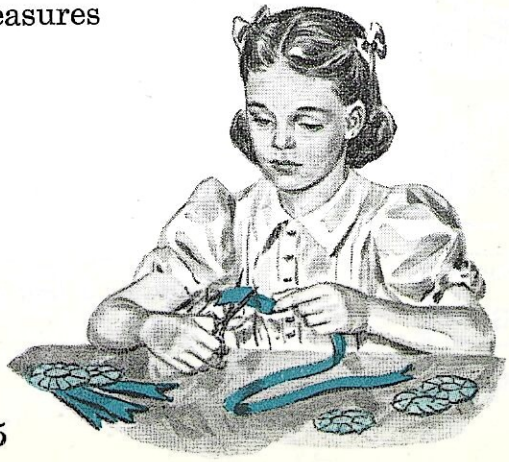
3. At 45¢ a yard, what should Nancy pay for the ribbon to make the prizes?

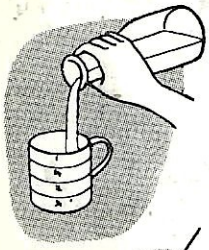
4. If Nancy pays for the ribbon with a five-dollar bill, how should the clerk count her change?

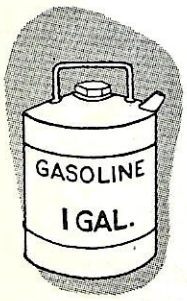
5. There are 9 children to share equally the cost of the prize ribbons. How much is each child's share?

6. Try to change these measures without looking at the table:

a. 4 ft. = _____ in.
b. 6 yd. = _____ ft.
c. 12 yd. = _____ in.
d. 27 ft. = _____ yd.
e. 2 mi. = _____ rd.
f. 2 mi. = _____ ft.
g. 42 da. = _____ wk.
h. 3 yr. = _____ mo.







Measuring Liquids

1. Make a list of liquids that are commonly measured with each unit of liquid measure.

2. Do you know anything that is measured in half pints? What measure is the same as a half pint?

3. Mrs. Ellis bought 4 half pints of cream at 35¢ each. How much did she pay for the cream?

4. Cream also sells for 65¢ a pint. How much would Mrs. Ellis have saved by asking for pints instead of half pints?

5. How many pints of milk would 8 quarts make?

6. What part of a quart is a pint? What part of a gallon is a quart?

7. How many quart bottles can Mr. Abbot pour from 16 gallons of milk?

8. Each of the 32 children is to be served a glass of sweet cider at the party. How many gallons of cider will be needed? At 70¢ a gallon, how much will the cider for the party cost?

9. Mrs. White got a gallon can of cherries. They had not been sweetened; so she heated them with sugar and canned them in pint jars. About how many pint jars did she use?

10. At $1.69 a gallon, what will 3 gallons of canned cherries cost?

Table of Liquid Measure

2 cups or 2 half pints	*= 1 pint (pt.)*
2 pints	*= 1 quart (qt.)*
4 quarts	*= 1 gallon (gal.)*

Weights

Bill Bender was helping his father feed and water the chickens.

"Bill, will you take that bucket and fill it with water for the chickens," said Mr. Bender. "No, not the big bucket. It will be too heavy for you to carry."

"How much does the big bucket hold?" asked Bill.

"Four gallons," answered his father.

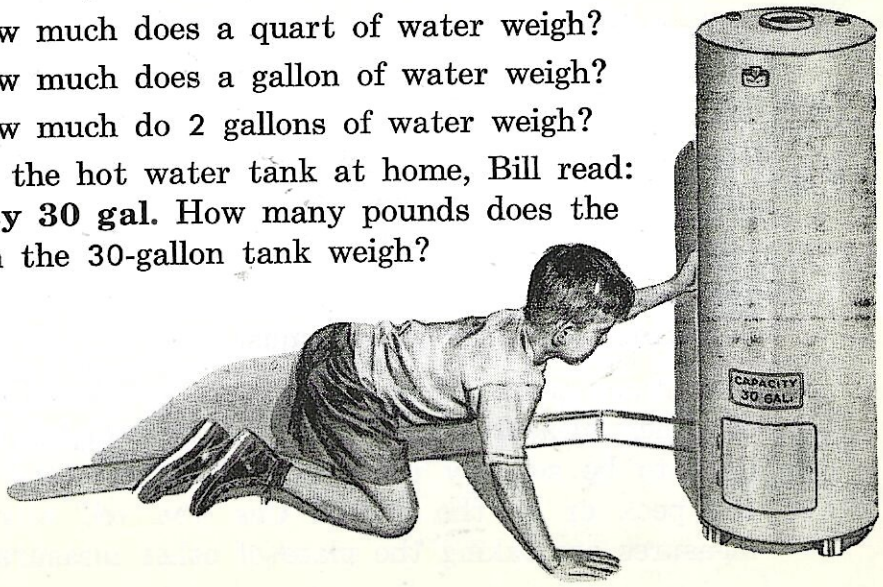
"How much do 4 gallons of water weigh?" asked Bill.

Mr. Bender answered, "A pint's a pound the world around. Then how much do 4 gallons weigh?"

At school the next day, Bill told his class about it. He weighed an empty pint bottle. Then he filled it with water and weighed it. The pint bottle of water weighed about a pound more than the empty bottle.

"Sure enough," said Bill. "A pint of water weighs just about a pound."

1. How much does a quart of water weigh?
2. How much does a gallon of water weigh?
3. How much do 2 gallons of water weigh?
4. On the hot water tank at home, Bill read: **Capacity 30 gal.** How many pounds does the water in the 30-gallon tank weigh?



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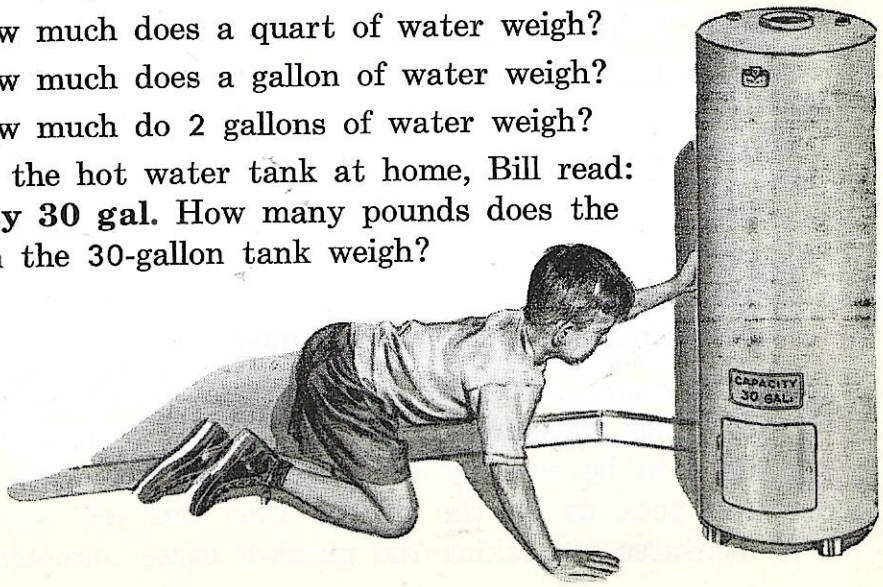


Measuring Weight

1. What unit would you use to measure your weight?

Table of Weight

16 ounces (oz.) = 1 pound (lb.)
2000 pounds = 1 ton (T.)

2. How many ounces are in $\frac{1}{4}$ of a pound? $\frac{1}{2}$ of a pound? $\frac{1}{8}$ of a pound?

3. How many pounds are in $\frac{1}{4}$ of a ton? $\frac{1}{2}$ of a ton?

4. A quarter-pound box of tea costs 35¢. How much will a pound of tea cost?

A pound of tea will probably cost a little less than four times as much as a quarter of a pound. Things are often sold a little cheaper in larger quantities.

5. At $8.75 a ton, what will 15 tons of coal cost?

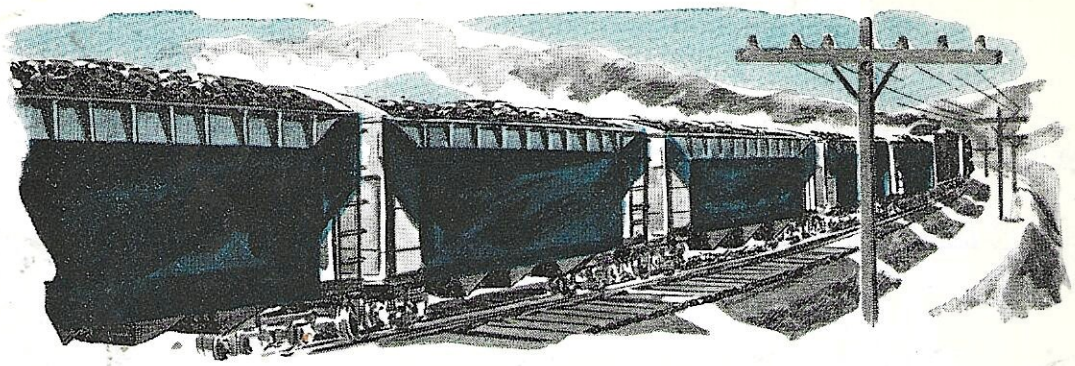
6. At $12.50 a ton, what will half a ton of coal cost?

7. A bushel of apples weighs about 50 pounds. Mr. Gable sold apples at 8¢ a pound. How much would he get for a bushel of them?

8. He paid $3.25 a bushel for the apples. How much did he make on each bushel?

Potatoes, fruits, and grains are among the things that are often sold by weight. The bushel is used as a **container**, but the weight must be a certain amount.

In many places things that were once sold by units of other measures are now sold by weight. Bananas used to be sold by the dozen. Potatoes were sold by the peck or by the bushel. Can you tell why weight measures are taking the place of other measures?



Tons and Tons

1. The picture shows a long coal train of 65 cars. In each car there is an average of 47 tons. How many tons of coal is the train hauling?

2. The cost of this coal at the coal mine was $3.75 a ton. How much was the cost of the trainload of coal?

3. The trainload is being hauled to a city where it will be delivered in trucks to homes. Because of the cost of hauling and trucking, the coal will cost each homeowner $8.40 a ton. Mr. Ballin has bought a supply of 9 tons for his home furnace. How much will the coal cost?

4. The 9 tons Mr. Ballin bought were ordinary tons, or "short" tons. A homeowner in England bought a supply of 8 tons for his furnace. But, as is the British custom, he bought his coal in "long" tons. Who bought more coal, Mr. Ballin or the Englishman?

2240 pounds = 1 long ton

5. Last winter Mr. Ballin used 12 tons of coal. By having his furnace repaired, he can manage to get along with 9 tons this winter. How much will Mr. Ballin save at $8.40 a ton?

Dry Measures

Many things that were once measured by dry measure are now measured by weight. Since some of the units are still used for convenience, we should at least know something about them.

Table of Dry Measure

2 pints (pt.) = 1 quart (qt.)
8 quarts = 1 peck (pk.)
4 pecks = 1 bushel (bu.)

1. Sam and Tom paid $4.00 for a bushel of cherries. They put the cherries into quart boxes, which they sold at 20¢ a quart. How much did they make?

2. Art raised potatoes last summer. His crop made 63 bushels. He sold the potatoes at $2.00 a bushel. How much did he get for them?

3. Mr. Axel at the Main Street Grocery bought some of Art's potatoes. He paid $2.00 a bushel for them. He sold them at 8¢ a pound. How much did he get for each bushel? (A bushel of potatoes weighs 60 pounds.) How much did he make on each bushel?

4. How many quarts would there be in 3 pecks of beans?

5. How many pounds would a half bushel of apricots weigh? (A bushel of apricots weighs 48 pounds.)

6. Jane and Sue picked blueberries to sell. They picked a half bushel and put them into pint boxes. How many pint boxes could they fill?

7. The girls sold the berries at 28¢ a box. How much money did they get for their berries?

Do You Know the Measures? [Test]

1. Tell what each unit below is used to measure:

inch	quart	dozen	foot	bushel
minute	yard	month	pound	peck
gallon	ounce	cup	ton	mile
century	rod	year	second	hour
pint	day	week	carat	degree

2. Copy these statements, putting in the right numbers:

1 lb. = ___ oz.	1 gal. = ___ qt.	$\frac{1}{4}$ lb. = ___ oz.
1 hr. = ___ min.	1 T. = ___ lb.	8 qt. = ___ gal.
1 yd. = ___ ft.	1 yr. = ___ mo.	12 ft. = ___ yd.
1 doz. = ___ things	1 pt. = ___ cups	4 doz. = ___ things
1 wk. = ___ days	1 day = ___ hr.	$\frac{1}{2}$ T. = ___ lb.
1 ft. = ___ in.	1 qt. = ___ pt.	3 yr. = ___ mo.
1 min. = ___ sec.	1 yr. = ___ days	2 gal. = ___ cups

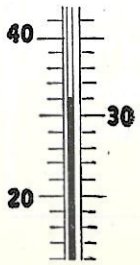
3. Change each measurement to the smaller unit:

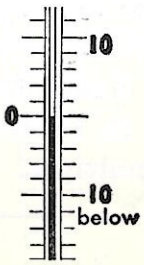
1 hr. 15 min.	1 min. 20 sec.	3 gal. 1 pt.
2 yr. 3 mo.	4 yd. 1 ft.	6 lb. 8 oz.
5 gal. 2 qt.	1 T. 540 lb.	5 ft. 4 in.

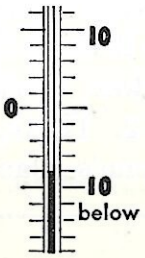
4. To change to larger units, should we multiply or divide?

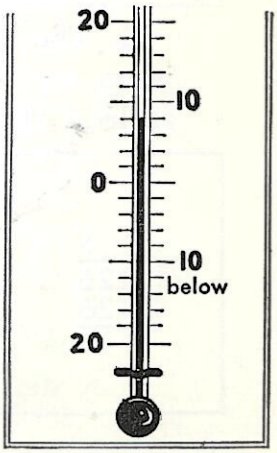
5. At what temperature does water freeze?

6. Explain a temperature of 8° below zero?









Chapter 11
Dividing by Tens and Ones

When to Divide

1. Sue bought 84 cookies to serve at her club meeting. How many cookies are there for each of the 21 members?

$$\begin{array}{r} 4 \\ 21\overline{)84} \\ \underline{84} \end{array}$$

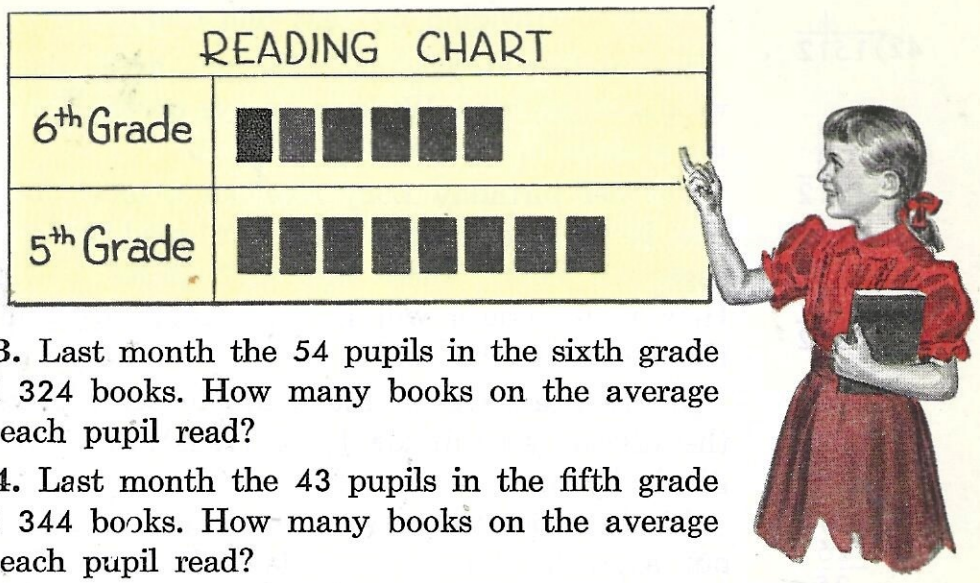
To answer the question, we divide 84 by 21. There are about as many 21's in 84 as there are 2's in 8. We are dividing 84 ones by 21; so we write the 4 in one's place.

Each member may have 4 cookies.

2. The club members have 126 grab-bag prizes to wrap for the community fair. How many prizes should each of the 21 members wrap?

$$\begin{array}{r} 6 \\ 21\overline{)126} \\ \underline{126} \end{array}$$

Keep an eye on the figure in ten's place in the divisor. Decide where to start writing the answer. Divide by 2 (tens) just as you divide by 2. Think, "Twos in twelve, six." Write 6 in one's place, and multiply.



3. Last month the 54 pupils in the sixth grade read 324 books. How many books on the average did each pupil read?

4. Last month the 43 pupils in the fifth grade read 344 books. How many books on the average did each pupil read?

5. There are 168 pages in one of the books Sue got at the library. Sue can read 42 pages an hour. How many hours will it take her to read this book?

6. Jane has 105 inches of ribbon to make 21 bookmarks. How long can each bookmark be?

Copy and divide:

	(*a*)	(*b*)	(*c*)	(*d*)	(*e*)	(*f*)
7.	$32\overline{)96}$	$21\overline{)84}$	$43\overline{)86}$	$51\overline{)153}$	$62\overline{)186}$	$71\overline{)355}$
8.	$83\overline{)249}$	$94\overline{)188}$	$12\overline{)48}$	$13\overline{)39}$	$11\overline{)99}$	$24\overline{)48}$
9.	$33\overline{)66}$	$42\overline{)126}$	$52\overline{)208}$	$61\overline{)549}$	$72\overline{)288}$	$84\overline{)168}$
10.	$93\overline{)279}$	$34\overline{)68}$	$51\overline{)459}$	$91\overline{)819}$	$24\overline{)72}$	$32\overline{)160}$
11.	$45\overline{)315}$	$74\overline{)370}$	$64\overline{)448}$	$56\overline{)280}$	$84\overline{)504}$	$93\overline{)651}$
12.	$25\overline{)100}$	$36\overline{)144}$	$44\overline{)264}$	$53\overline{)477}$	$65\overline{)390}$	$73\overline{)657}$
13.	$85\overline{)765}$	$96\overline{)864}$	$85\overline{)595}$	$37\overline{)111}$	$55\overline{)330}$	$95\overline{)475}$

Dividing by Tens and Ones

$$42\overset{\downarrow}{)}1512$$

In dividing by tens and ones, we divide the way we divide by tens. We keep an eye on the figure in ten's place in the divisor.

$$\begin{array}{r} 3 \\ 42\overline{)1512} \end{array}$$

For her birthday Lucy received a set of books. She is a good reader. She can read about 42 pages an hour. There are 1512 pages to read. How many hours will it take Lucy to read all the books in the set?

$$\begin{array}{r} 3 \\ 42\overline{)1512} \\ \underline{126} \end{array}$$

We keep an eye on the figure in ten's place in the divisor and divide by 4 (tens) the way we divide by 4.

$$\begin{array}{r} 3 \\ 42\overline{)1512} \\ \underline{126} \\ 25 \end{array}$$

First, notice where we write the first figure in our answer. Think, "Forty-twos in 1, no. Forty-twos in 15, no. Forty-twos in 151, yes." We start to write our answer in ten's place above the 1 in 1512.

$$\begin{array}{r} 3 \\ 42\overline{)1512} \\ \underline{126} \\ 252 \end{array}$$

Divide: Fours in fifteen, three. We write 3 in our answer in its proper place.

Multiply: Multiply 42 by 3. Notice that the product, 126, is not greater than the partial dividend, 151, above it.

$$\begin{array}{r} 36 \\ 42\overline{)1512} \\ \underline{126} \\ 252 \end{array}$$

Subtract: Subtract 126 from 151. Notice that the remainder, 25, is less than the divisor, 42.

Bring down: Bring down the next figure, 2.

Now divide 252 by 42: Fours in twenty-five, six.

$$\begin{array}{r} 36 \\ 42\overline{)1512} \\ \underline{126} \\ 252 \\ \underline{252} \end{array}$$

Multiply 42 by 6. Notice that the product is the same as the partial dividend above it. There is no remainder and there is nothing to bring down; so the dividing is finished.

Helping Others

1. The pupils in the fifth grade collected 550 magazines to send to the children in the hospital. They tied the magazines in bundles of 25 each. How many bundles did they have to send?

2. The 22 girls in the class collected and painted 484 spools. If each girl painted the same number, how many spools did each girl paint?

3. The girls gave 276 spools to the boys to make toys. The 12 boys divided the spools equally. How many spools did each boy get?

4. The girls used the 208 spools that were left to make spool dolls. They used 8 spools for each doll. How many dolls did they make?

Practice

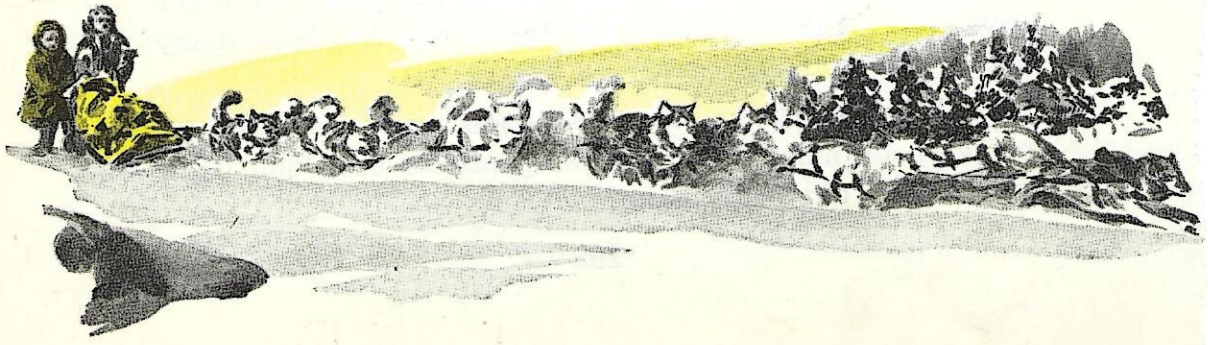
1. Notice how these examples are worked:

$$\begin{array}{r} 23 \\ 21\overline{)483} \\ 42 \\ \hline 63 \\ 63 \\ \hline \end{array} \qquad \begin{array}{r} 45 \\ 32\overline{)1440} \\ 128 \\ \hline 160 \\ 160 \\ \hline \end{array} \qquad \begin{array}{r} 27 \\ 41\overline{)1107} \\ 82 \\ \hline 287 \\ 287 \\ \hline \end{array} \qquad \begin{array}{r} 36 \\ 62\overline{)2232} \\ 186 \\ \hline 372 \\ 372 \\ \hline \end{array} \qquad \begin{array}{r} 38 \\ 73\overline{)2774} \\ 219 \\ \hline 584 \\ 584 \\ \hline \end{array}$$

Copy and divide:

	(*a*)	(*b*)	(*c*)	(*d*)	(*e*)
2.	$23\overline{)1196}$	$44\overline{)2728}$	$61\overline{)5551}$	$73\overline{)1606}$	$85\overline{)3825}$
3.	$32\overline{)1440}$	$45\overline{)1935}$	$62\overline{)2852}$	$74\overline{)5328}$	$91\overline{)7917}$
4.	$34\overline{)2074}$	$51\overline{)2907}$	$63\overline{)4662}$	$75\overline{)5550}$	$92\overline{)3956}$
5.	$32\overline{)2976}$	$52\overline{)3484}$	$64\overline{)1536}$	$81\overline{)5265}$	$31\overline{)1457}$
6.	$45\overline{)1125}$	$62\overline{)3596}$	$74\overline{)4514}$	$91\overline{)8918}$	$32\overline{)2368}$
7.	$51\overline{)2346}$	$63\overline{)5292}$	$75\overline{)6150}$	$92\overline{)4876}$	$32\overline{)2688}$
8.	$52\overline{)3900}$	$64\overline{)2240}$	$81\overline{)6156}$	$93\overline{)6882}$	$41\overline{)3567}$
9.	$53\overline{)1749}$	$65\overline{)3445}$	$32\overline{)1792}$	$51\overline{)1479}$	$63\overline{)5985}$

10. Jerry read a story about Eskimos. In the story a dog team made a trip of 441 miles from noon April 2 to noon April 23. How many miles a day did the dog team average?



Zero in the Quotient

1. Jack lives on the farm. He has 36 hens. He keeps a record of the number of eggs they lay. During October they laid a total of 720 eggs. How many eggs on the average did each hen lay during October?

$$\begin{array}{r} 20 \\ 36\overline{)720} \\ \underline{72} \\ 0 \end{array}$$

Study these examples:

$$\begin{array}{r} 30 \\ 41\overline{)1230} \\ \underline{123} \\ 0 \end{array} \qquad \begin{array}{r} 50 \\ 56\overline{)2800} \\ \underline{280} \\ 0 \end{array} \qquad \begin{array}{r} 40 \\ 49\overline{)1960} \\ \underline{196} \\ 0 \end{array}$$

2. Joe and his father are going on a 600-mile trip. If they average 30 miles an hour, how long will it take them to make the trip?

3. Tom went with his father on a 750-mile trip. The trip took 25 hours. Find the average number of miles traveled in an hour.

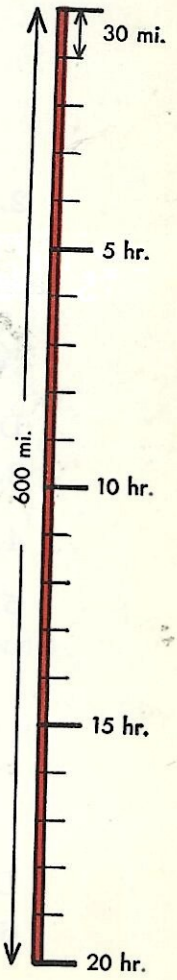
4. Jim is helping to set out 1000 cabbage plants. His father said, "I will plant the first row of 20 plants while you mark off the other rows."

How many rows of cabbage will they have?

How many rows should Jim mark off?

5. The 32 boys and girls in the class sold 1920 Christmas seals. What was the average number of Christmas seals sold by each pupil?

6. Henry said, "Father and I took a truckload of wheat to town. The wheat alone weighed 3180 pounds. A bushel of wheat weighs 60 pounds. How many bushels were in the load?"



Practicing Division

1. Study the work of each example carefully. Then copy the examples, and divide without the book. Check.

(a)	(b)	(c)	(d)	(e)
12	21	12	11	21
12)144	23)483	32)384	25)275	41)861
12	46	32	25	82
24	23	64	25	41
24	23	64	25	41

2. In these examples the correct quotient figures are given. Copy the examples and finish the dividing. Check each quotient.

13	11	13	41	22
13)169	24)264	12)156	12)492	31)682

Divide and check:

3. 12)168 21)441 23)299 34)374 22)286

4. 11)176 14)294 12)252 23)276 15)165

5. Watch the subtraction in these division examples. Study the examples. Then copy, work, and check them.

12	12	41	23	21
34)408	44)528	22)902	31)713	24)504
34	44	88	62	48
68	88	22	93	24
68	88	22	93	24

Divide and check:

6. 23)506 32)736 22)528 33)726 42)924

7. 42)882 23)759 81)891 12)372 31)651

8. 72)864 60)960 83)913 56)952 62)806

More Examples to Study and Work

1. We must often carry when we multiply. Study these examples. Then work and check them.

(*a*)	(*b*)	(*c*)	(*d*)	(*e*)
21	26	25	24	25
25)525	32)832	22)550	34)816	32)800
50	64	44	68	64
25	192	110	136	160
25	192	110	136	160

Divide and check:

2.	24)552	35)805	36)864	26)598	37)814
3.	45)945	56)728	43)946	37)777	63)945
4.	74)888	32)768	19)209	25)575	24)576

5. Many dividends have three or more figures. It will help us to find how many figures to use for the first partial dividend if we think of the numbers as bundles of thousands, hundreds, or tens.

Will we use 1 thousand, 10 hundreds, or 103 tens for the first partial dividend? Why?

How will we find the first quotient figure?

Why do we write this figure in ten's place in the quotient?

Tell how the rest of the example is worked.

```
   24
43)1032
   86
  172
  172
```

Divide and check:

6.	21)1092	74)1036	32)1088	64)1472	52)1248
7.	27)594	21)1134	44)1012	23)966	35)875
8.	22)550	42)1596	52)3900	45)990	83)1992
9.	41)3116	94)1504	38)456	26)1118	49)1127

Dividing Dollars and Cents

1. The 42 pupils in the fifth grade at the Wilson School planned an all-day picnic at Lincoln Park. They found that the total cost of everything they would need, including bus fares and the fruit and ice cream they wanted to get, would be $15.96. They decided to share the expense equally. How much was each pupil's share?

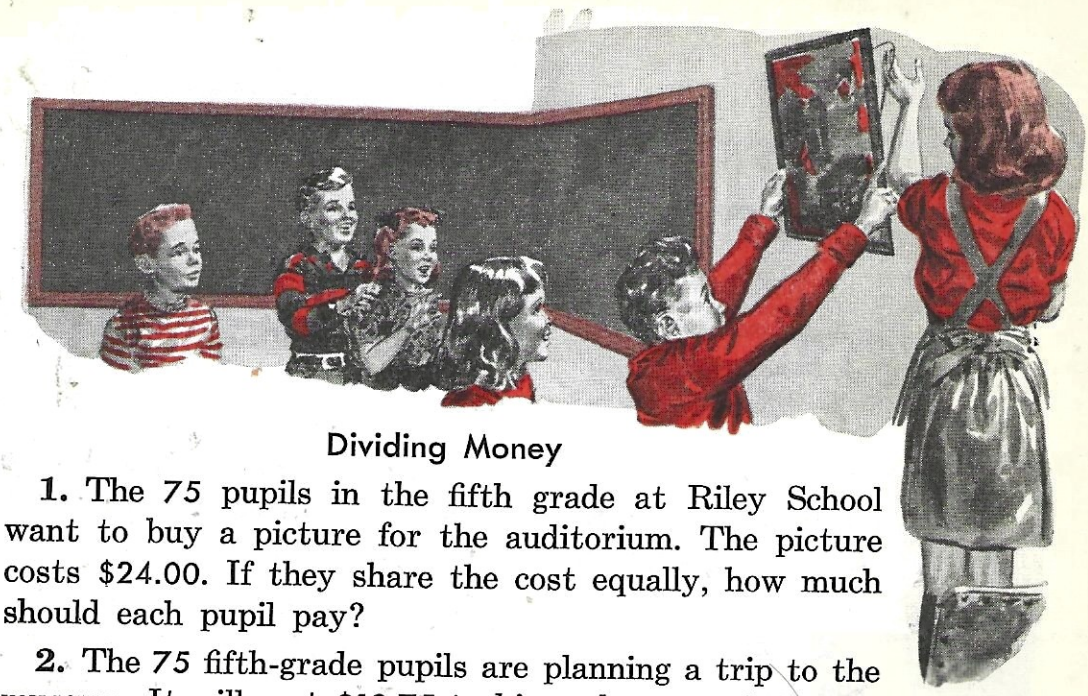
```
      $.38
42)$15.96
   126
    336
    336
```

We divide $15.96 by 42 the way we would divide 1596 by 42. But we must be careful to write each part of our answer **in its proper place** and to put the point **in its proper place.**

2. During a certain week there were 72 girls at Camp Buddy. The total cost of running the camp that week was $313.92. How much was that for each girl?

Divide:

	(*a*)	(*b*)	(*c*)	(*d*)
3.	23)$11.96	44)$27.28	61)$55.51	73)$16.06
4.	23)$119.83	44)$273.68	61)$558.15	73)$166.44



Dividing Money

1. The 75 pupils in the fifth grade at Riley School want to buy a picture for the auditorium. The picture costs $24.00. If they share the cost equally, how much should each pupil pay?

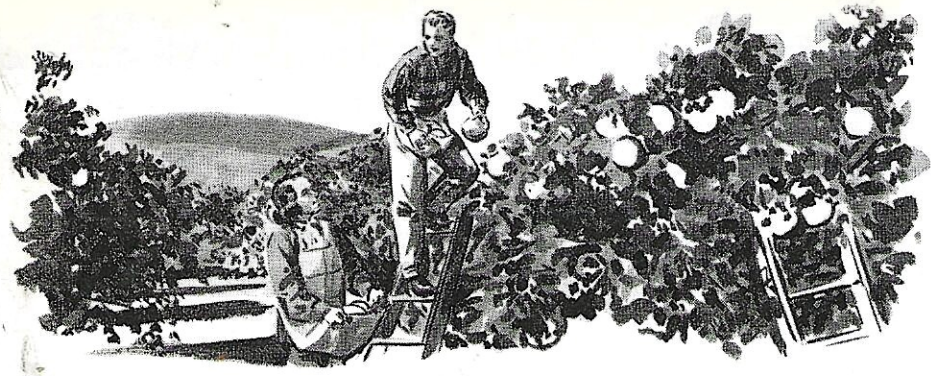
2. The 75 fifth-grade pupils are planning a trip to the museum. It will cost $18.75 to hire a bus to take them. If each pupil pays an equal share, how much should each one pay?

3. Each pupil must also pay 12¢ to go down into the coal mine at the museum. Each one has arranged to carry his lunch and to take 8¢ for milk. What should the trip cost each pupil?

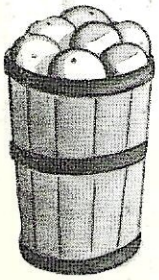
4. How much should a pupil have left from a dollar bill after he pays for his trip?

Divide and check:

	(a)	(b)	(c)	(d)	(e)
5.	41)$21.73	83)$11.62	67)$17.42	15)$1.65	59)$14.16
6.	32)$20.48	50)$18.00	74)$25.16	35)$18.20	23)$11.96
7.	21)$11.76	13)$7.28	33)$6.93	24)$10.32	77)$20.79
8.	59)$8.85	66)$35.64	27)$3.24	76)$34.20	40)$22.40



Sally Sends a Gift



1. Soon after Sally moved to Texas, she sent a bushel of grapefruit to her five best girl friends. In the basket there were 50 grapefruit. The girls shared them equally. How many grapefruit did each girl get?

2. Sally paid \$5.00 for the grapefruit. This included the cost of sending them. How much did Sally's gift to each of her 5 friends amount to?

3. At \$5.00 a bushel, what would be the cost of each of the 50 grapefruit?

Work and check these division examples:

	(*a*)	(*b*)	(*c*)	(*d*)	(*e*)	(*f*)
4.	$4\overline{)844}$	$6\overline{)606}$	$3\overline{)960}$	$8\overline{)168}$	$5\overline{)305}$	$9\overline{)180}$
5.	$6\overline{)84}$	$5\overline{)110}$	$9\overline{)468}$	$7\overline{)518}$	$4\overline{)904}$	$8\overline{)952}$
6.	$8\overline{)4368}$	$4\overline{)2928}$	$6\overline{)4518}$	$3\overline{)1071}$	$9\overline{)8532}$	$7\overline{)6272}$
7.	$4\overline{)824}$	$7\overline{)2135}$	$5\overline{)2015}$	$6\overline{)5448}$	$3\overline{)1527}$	$9\overline{)6354}$
8.	$7\overline{)\$3.50}$	$9\overline{)\$9.27}$	$5\overline{)\$6.00}$	$2\overline{)\$17.04}$	$8\overline{)\$16.96}$	$6\overline{)\$5.94}$
9.	$30\overline{)90}$	$50\overline{)400}$	$42\overline{)84}$	$31\overline{)93}$	$62\overline{)248}$	$93\overline{)279}$
10.	$34\overline{)204}$	$47\overline{)188}$	$54\overline{)432}$	$83\overline{)747}$	$79\overline{)553}$	$68\overline{)340}$

Estimating Answers

Decide which of the three answers seems about right. Do not work the problem.

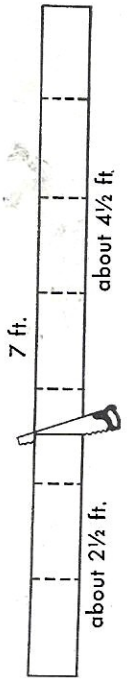
1. Nine boys bought a boat for $17.10. They divided the expense equally. How much was each boy's share? $2.00 $1.50 $2.50

2. Jim gathered 108 eggs one day. How many dozen eggs did he get? 10 doz. 8 doz. 9 doz.

3. One Sunday the West family went for a car ride. When they started, the speedometer showed 6492. When they got home, it showed 6587. How many miles did they ride? 100 mi. 5 mi. 15 mi.

4. Another Sunday the Wests took an 85-mile ride. They were gone about 3 hours. What was their average distance each hour? 20 mi. 30 mi. 40 mi.

5. Jack had a board 7 ft. long. He sawed off a piece $2\frac{5}{8}$ ft. long to mend his wagon. How long was the piece that was left? 3 ft. 4 ft. $4\frac{1}{2}$ ft. 8 ft.

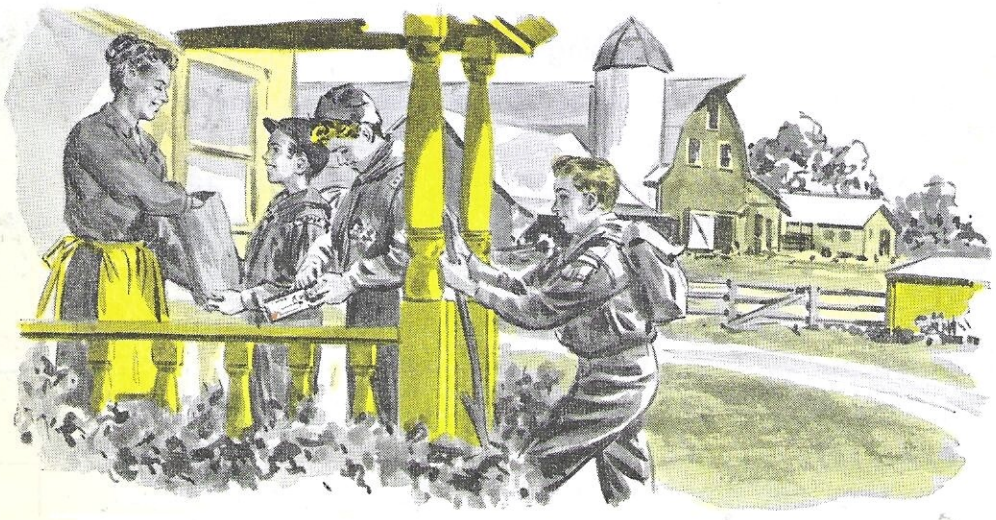


6. Ann bought a dress for $5.95 and a purse for $1.98. How much did her new things cost in all? $8.00 $6.00 $7.00.

7. Betty bought 3 yards of material for a new dress. She paid 89¢ a yard for it. How much did she pay for the material? $3.00 $2.25 $2.70.

8. Dan bought a model airplane for $1.35 and 2 bicycle tires for $3.30. How much did he spend in all? $8.00 $4.00 $4.50.

Now start over. Work each problem. Was your estimate about the same as your answer?



The Boy Scouts Go Camping

1. Twelve Boy Scouts planned a week-end trip to their hut. For their breakfasts they bought 3 pounds of bacon at 69¢ a pound and 3 loaves of bread at 16¢ a loaf. How much did these things cost?

2. At a farm near the hut the boys bought 3 dozen eggs at 35¢ a dozen, 1 gallon of milk for 40¢, and 1 pound of butter for 50¢. How much did they pay the farmer's wife for her produce? The boys paid the farmer's wife with a five-dollar bill. How much change did they get? Count the change.

3. Early Saturday morning the boys started on a hike. They were gone for 3 hours and walked about 9 miles. What was the average distance they walked each hour?

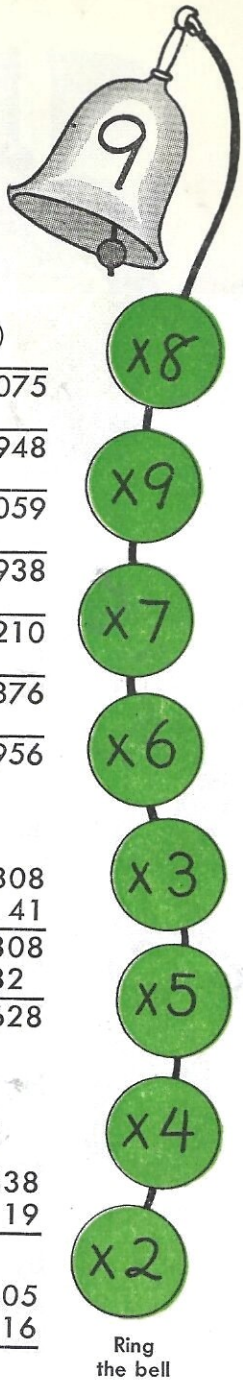
4. The total expenses for the week end amounted to $27.60. How much did each one pay if the twelve boys shared equally in the expenses?

Practicing Division

Keep an eye on the figure **in ten's place** in the divisor. Divide by tens and ones the way you would divide by ones.

Divide:

	(a)	(b)	(c)	(d)
1.	64)2816	81)7047	93)7905	41)3075
2.	53)2279	65)2795	82)5904	94)3948
3.	42)1932	54)2862	71)4331	83)6059
4.	31)2263	53)3445	64)3584	81)7938
5.	93)8928	41)2747	53)2915	65)2210
6.	82)5166	94)4888	65)1690	54)2376
7.	71)5964	83)6889	95)1425	43)3956



Ring the bell

Practicing Multiplication

Study:

5280	2042	6308
12	26	41
10 560	12 252	6 308
52 80	40 84	252 32
63,360	53,092	258,628

Multiply:

	(a)	(b)	(c)	(d)	(e)	(f)
8.	1335 × 9	2733 × 8	6219 × 2	3796 × 65	5723 × 78	7838 × 19
9.	$19.50 × 14	$23.72 × 25	$9.89 × 48	$8.52 × 30	$10.10 × 50	$5.05 × 16

Problems

1. Sarah paid \$12.25 for a coat, \$2.50 for a hat, and \$4.50 for a pair of shoes. How much did Sarah spend?

2. How much more did Sarah have to pay for the coat than for the pair of shoes?

3. Sarah had \$24.17 in her purse before she paid for her clothes. She paid \$19.25 for the clothes she bought. How much did she have left after she paid for them?

4. Sarah owed the saleslady who waited on her \$19.25. Sarah gave the saleslady a 20-dollar bill. How much change did Sarah get back?

5. William bought 4 shirts. He paid \$7.60 for them. How much did he pay for each shirt?

6. William's father bought 3 shirts. Each shirt cost \$1.38. How much did the shirts cost?

7. During the summer vacation William made \$43.61 by running errands and by helping at the grocery. He saved most of it, but kept $\frac{1}{7}$ of it for spending money. How much did he keep for spending money?

Practice

Add:

	(a)	(b)	(c)	(d)	(e)	(f)
1.	5146 2738	2856 5372	9375 8031	4087 5906	7698 6742	2657 1890
2.	\$505.70 458.39 263.45	\$376.35 493.95 326.30	\$557.12 653.56 280.55	\$643.31 425.78 655.93	\$127.63 367.48 408.23	\$989.40 227.12 337.21
3.	\$527.50 358.46 297.53 654.40	\$257.00 625.40 384.00 259.63	\$735.60 207.75 342.68 128.50	\$350.00 468.28 301.60 280.42	\$486.35 275.53 432.34 729.63	\$266.58 407.10 420.00 500.00

Subtract:

4.	7398 4756	5681 2385	6035 4723	27,842 13,930	8002 4375	9000 3456
5.	\$738.62 427.53	\$785.70 453.35	\$570.25 246.80	\$564.75 257.80	\$800.00 356.79	\$1000.00 785.75

Multiply:

6.	748 4	562 5	784 7	2837 9	286 28	435 73
7.	1467 9	3527 8	4276 2	3428 56	4634 47	3496 18
8.	\$27.50 37	\$12.48 25	\$7.65 38	\$5.75 50	2600 78	4060 19

Divide:

9.	$5\overline{)9735}$	$4\overline{)8924}$	$8\overline{)19984}$	$20\overline{)3540}$	$40\overline{)11040}$	$80\overline{)5200}$
10.	$42\overline{)1134}$	$61\overline{)5002}$	$54\overline{)1404}$	$22\overline{)1364}$	$10\overline{)7850}$	$30\overline{)2940}$

Test

Read these sentences, saying the right word for each blank space:

1. Susan bought 12 eggs at the store. She used 3 of them to make a cake. She used ____ ____ of the eggs.

2. To find $\frac{1}{4}$ of any number, *divide* the number by *four.*

3. To find $\frac{1}{4}$ of anything, we divide it into ____ ____ parts.

4. To find $\frac{1}{6}$ of any number, we ____ the number by ____.

5. To find $\frac{5}{6}$ of any number, we ____ the number by ____, and then ____ by ____.

6. Find $\frac{7}{8}$ of 48.

7. Find $\frac{3}{4}$ of 1636.

8. Find $\frac{3}{4}$ of $17.36.

9. Find $\frac{7}{12}$ of 3240.

10. Find $\frac{4}{5}$ of $122.80.

$\frac{5}{6}$ of 42 = ?
$\frac{1}{6}$ of 42 = ?
$\frac{5}{6}$ of 42 = 5 × 7 = 35

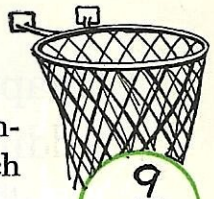
11. Tens and hundreds are added, subtracted, multiplied, and divided the way ____ are added, subtracted, multiplied, and divided. But we must be careful to write our ten's answer in ____ place and our hundred's answer in ____ place.

12. When we have no number to write in a place, we write ____ in that place in order to put the numbers we do have in their proper places.

13. We multiply by tens the way we multiply by ____, but we must write our ten's answer in ____ place.

14. We divide by tens the way we divide by ____, but we must write the answer we get in its proper place.

Kicking goals



Test

See how many of the following sentences you can complete correctly. Tell the word that should go in each blank space.

1. In order to change feet to inches, we must *multiply* the number of feet by *12*.

2. In order to change inches to yards, we must _____ the number of inches by _____.

3. In order to change gallons to pints, we must _____ the number of gallons by _____.

4. In order to change quarts to gallons, we must _____ the number of quarts by _____.

5. In order to change pounds to ounces, we must _____ the number of pounds by _____.

6. In order to change ounces to pounds, we must _____ the number of ounces by _____.

Find the answers:

7. Add $28.65, $37.50, $19.62, $25.00, and $19.95.

8. From $250.00 subtract $138.48.

9. Multiply $40.76 by 95; $63.92 by 87.

10. Divide $353.28 by 8; $154.07 by 71; $205.26 by 33.

11. Find $\frac{1}{5}$ of $38.65; $\frac{2}{9}$ of $81.18; $\frac{3}{8}$ of $9.60.

12. Find $\frac{3}{5}$ of $18.35; $\frac{5}{6}$ of $72.84; $\frac{3}{10}$ of $40.

13. Find $\frac{2}{7}$ of 14,420; $\frac{1}{6}$ of 9636; $\frac{3}{4}$ of 100.

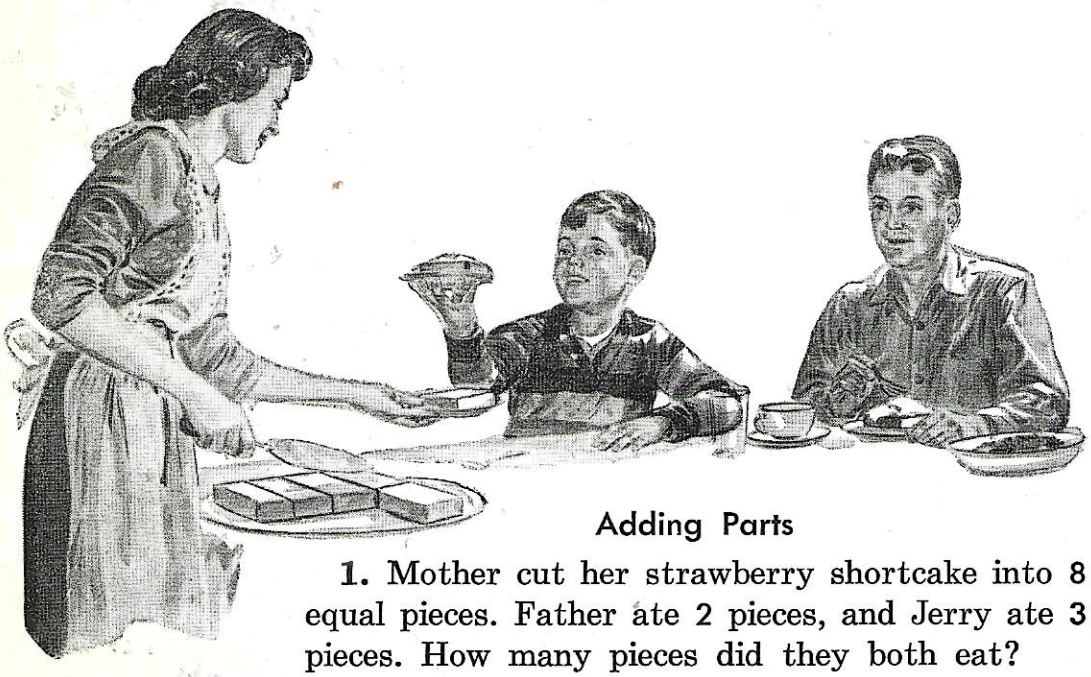
14. Find $\frac{5}{9}$ of $56.70; $\frac{5}{8}$ of $76.80; $\frac{1}{12}$ of $49.20.

15. Divide by 10: 8040; $10,010; 990; $73.40.

16. How many days are there in 8640 minutes?

Shooting goals

Chapter 12
Adding and Subtracting Fractions



Adding Parts

1. Mother cut her strawberry shortcake into 8 equal pieces. Father ate 2 pieces, and Jerry ate 3 pieces. How many pieces did they both eat?

2. Mother cut her strawberry shortcake into 8 equal pieces. Father ate 2 eighths, and Jerry ate 3 eighths. How much did they both eat?

3. Mother cut her strawberry shortcake into 8 equal pieces. Father ate $\frac{2}{8}$, and Jerry ate $\frac{3}{8}$. How much did they both eat?

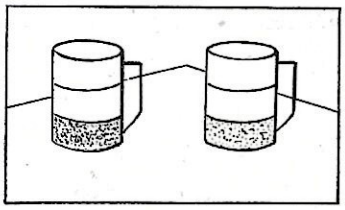
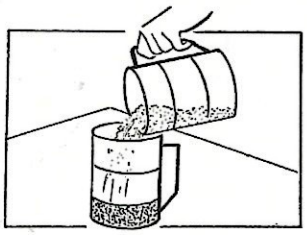
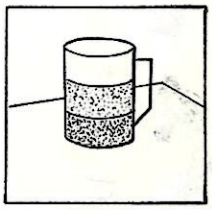
Problems **1**, **2**, and **3** are really the same problem. This is the way we write what each one tells:

2 pieces	2 eighths		$\frac{2}{8}$
3 pieces	3 eighths	$\frac{2}{8} + \frac{3}{8} = \frac{5}{8}$	$\frac{3}{8}$
5 pieces	5 eighths		$\frac{5}{8}$

We add parts the way we add wholes.

5 pencils	5 eighths	$\frac{5}{8} + \frac{2}{8} = \frac{7}{8}$	$\frac{5}{8}$
2 pencils	2 eighths		$\frac{2}{8}$
7 pencils	7 eighths		$\frac{7}{8}$

4. Mary is making a pudding. It takes $\frac{1}{3}$ of a cup of brown sugar and $\frac{1}{3}$ of a cup of white sugar. How much sugar is needed for the pudding?

5. Tell how we add the fractions in each box:

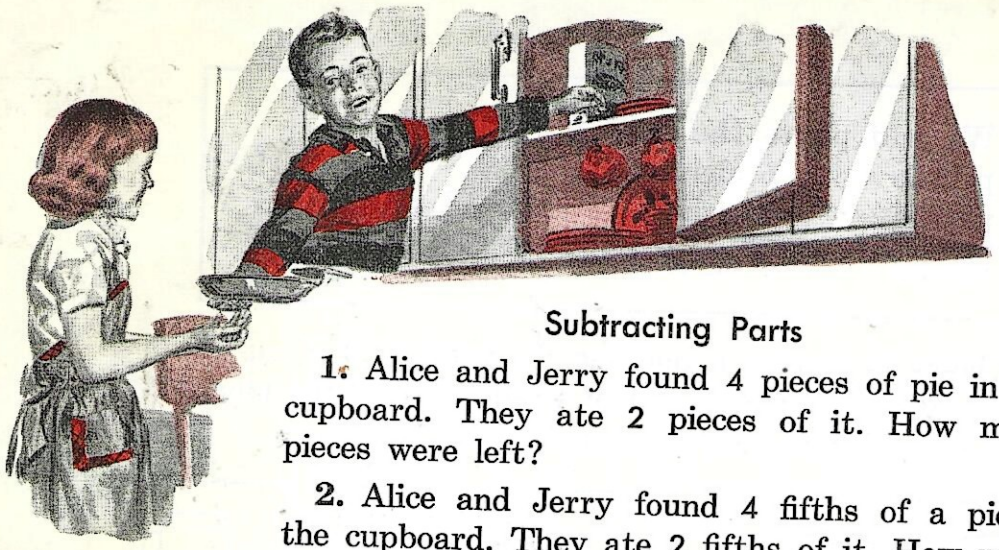
A	B	C
2 fifths $\frac{2}{5}$	1 fourth $\frac{1}{4}$	3 sixths $\frac{3}{6}$
1 fifth $\frac{1}{5}$	2 fourths $\frac{2}{4}$	2 sixths $\frac{2}{6}$
fifths $\frac{\quad}{\quad}$	fourths $\frac{\quad}{\quad}$	sixths $\frac{\quad}{\quad}$

6. Add these fractions aloud:

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
$\frac{1}{6}$	$\frac{1}{8}$	$\frac{3}{10}$	$\frac{1}{5}$	$\frac{2}{5}$	$\frac{4}{8}$	$\frac{2}{6}$	$\frac{4}{8}$	$\frac{2}{8}$	$\frac{2}{7}$
$\frac{4}{6}$	$\frac{4}{8}$	$\frac{6}{10}$	$\frac{3}{5}$	$\frac{2}{5}$	$\frac{1}{8}$	$\frac{3}{6}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{7}$
$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$

7. Copy and add these fractions. Write the answers.

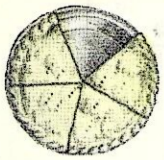
$\frac{5}{8}$	$\frac{2}{9}$	$\frac{1}{5}$	$\frac{3}{10}$	$\frac{5}{12}$	$\frac{1}{9}$	$\frac{2}{4}$	$\frac{1}{7}$	$\frac{5}{16}$	$\frac{1}{3}$
$\frac{2}{8}$	$\frac{5}{9}$	$\frac{2}{5}$	$\frac{4}{10}$	$\frac{2}{12}$	$\frac{4}{9}$	$\frac{1}{4}$	$\frac{3}{7}$	$\frac{4}{16}$	$\frac{1}{3}$
$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$



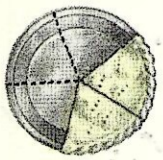
Subtracting Parts

1. Alice and Jerry found 4 pieces of pie in the cupboard. They ate 2 pieces of it. How many pieces were left?

2. Alice and Jerry found 4 fifths of a pie in the cupboard. They ate 2 fifths of it. How much was left?



3. Alice and Jerry found $\frac{4}{5}$ of a pie in the cupboard. They ate $\frac{2}{5}$ of it. How much was left?



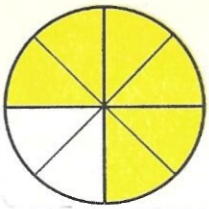
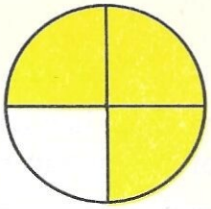
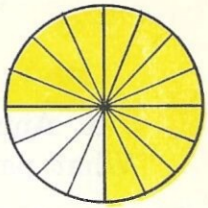
Problems **1**, **2**, and **3** are really the same problem. This is the way we write what each one tells:

4 pieces	4 fifths	$\frac{4}{5} - \frac{2}{5} = \frac{2}{5}$	$\frac{4}{5}$
−2 pieces	−2 fifths		$-\frac{2}{5}$
2 pieces	2 fifths		$\frac{2}{5}$

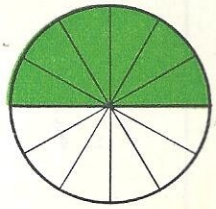
We subtract parts the way we subtract wholes.

Copy and subtract:

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
4.	$\frac{2}{4}$	$\frac{2}{8}$	$\frac{4}{8}$	$\frac{2}{3}$	$\frac{3}{6}$	$\frac{5}{6}$	$\frac{7}{9}$	$\frac{6}{8}$	$\frac{5}{7}$	$\frac{9}{16}$
	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{3}$	$\frac{2}{6}$	$\frac{4}{6}$	$\frac{2}{9}$	$\frac{3}{8}$	$\frac{2}{7}$	$\frac{4}{16}$
5.	$\frac{6}{7}$	$\frac{7}{8}$	$\frac{3}{4}$	$\frac{6}{8}$	$\frac{7}{8}$	$\frac{4}{5}$	$\frac{9}{12}$	$\frac{8}{16}$	$\frac{6}{9}$	$\frac{9}{10}$
	$\frac{3}{7}$	$\frac{2}{8}$	$\frac{2}{4}$	$\frac{1}{8}$	$\frac{4}{8}$	$\frac{3}{5}$	$\frac{4}{12}$	$\frac{5}{16}$	$\frac{4}{9}$	$\frac{2}{10}$

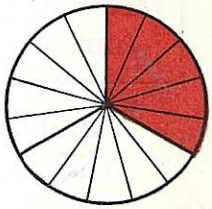
Changing to Lowest Terms



How many eighths of the circle are shaded?
How many fourths of the circle are shaded?

$$\frac{6}{8} = \frac{3}{4}$$

If we did not know that $\frac{6}{8} = \frac{3}{4}$ and we wanted to find out, we could divide the numerator and denominator by the same number, 2.



$$\frac{6 \div 2}{8 \div 2} = \frac{3}{4}$$

Changing $\frac{6}{8}$ to $\frac{3}{4}$ is called **changing to lowest terms.**

Ann's Work	*Andrew's Work*
$\frac{12}{16} = \frac{12 \div 4}{16 \div 4} = \frac{3}{4}$	$\frac{12}{16} = \frac{12 \div 2}{16 \div 2} = \frac{6}{8} = \frac{6 \div 2}{8 \div 2} = \frac{3}{4}$

Ann divided the numerator and the denominator by 4.

Andrew divided the numerator and the denominator by 2 and got $\frac{6}{8}$. This is correct as far as it goes. Then Andrew saw that he could divide 6 and 8 by 2. He did and got the same answer as Ann. Both Ann and Andrew got the same answer. Which work is simpler?

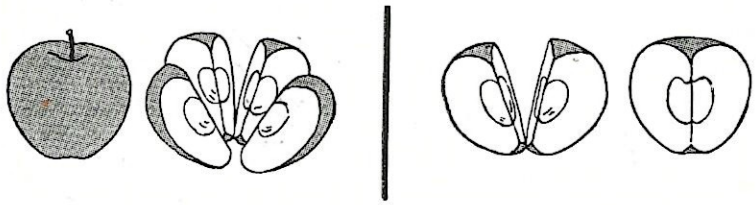
Change to lowest terms:

	(*a*)	(*b*)	(*c*)	(*d*)	(*e*)	(*f*)	(*g*)	(*h*)	(*i*)
1.	$\frac{8}{16}$	$\frac{10}{15}$	$\frac{8}{12}$	$\frac{6}{12}$	$\frac{6}{18}$	$\frac{5}{15}$	$\frac{12}{32}$	$\frac{24}{36}$	$\frac{4}{8}$
2.	$\frac{9}{18}$	$\frac{15}{20}$	$\frac{20}{24}$	$\frac{3}{36}$	$\frac{2}{8}$	$\frac{8}{32}$	$\frac{4}{6}$	$\frac{4}{12}$	$\frac{3}{9}$
3.	$\frac{16}{24}$	$\frac{9}{36}$	$\frac{12}{16}$	$\frac{4}{16}$	$\frac{15}{18}$	$\frac{4}{24}$	$\frac{6}{9}$	$\frac{8}{24}$	$\frac{2}{10}$

Adding Fractions

1. Ann gave $\frac{1}{4}$ of her apple to Jane and $\frac{1}{4}$ of it to Sue. What part of the apple did Ann give away?

$\frac{1}{4}$
$\frac{1}{4}$
$\frac{2}{4} = \frac{1}{2}$



The sum of the parts is $\frac{2}{4}$. But $\frac{2}{4}$ can be changed to $\frac{1}{2}$. Ann gave away $\frac{1}{2}$ of her apple.

2. Dick gave $\frac{1}{6}$ of his stamps to Jim and $\frac{1}{6}$ to Ray. What part of his stamps did he give away?

3. Mary poured $\frac{1}{3}$ of a cup of grape juice into $\frac{1}{3}$ cup of water. What part of a cup did Mary fill?

4. Study these examples:

$\frac{5}{8} + \frac{1}{8} = \frac{6}{8} = \frac{3}{4}$ $\quad \frac{5}{9} + \frac{1}{9} = \frac{6}{9} = \frac{2}{3}$ $\quad \frac{1}{6} + \frac{1}{6} = \frac{2}{6} = \frac{1}{3}$

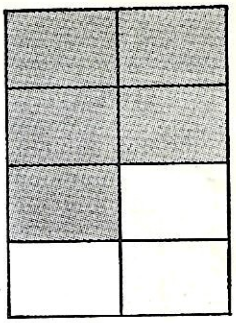
5. Add these fractions aloud. Remember: The sum may be a fraction that should be changed to lowest terms.

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{5}{16}$	$\frac{1}{9}$	$\frac{4}{9}$	$\frac{5}{12}$	$\frac{2}{7}$	$\frac{1}{5}$
$\frac{3}{8}$	$\frac{1}{4}$	$\frac{5}{8}$	$\frac{3}{16}$	$\frac{4}{9}$	$\frac{2}{9}$	$\frac{1}{12}$	$\frac{3}{7}$	$\frac{3}{5}$

6. Add these fractions. Write the answer in lowest terms.

$\frac{1}{10}$	$\frac{1}{6}$	$\frac{3}{10}$	$\frac{7}{12}$	$\frac{5}{12}$	$\frac{3}{8}$	$\frac{1}{12}$	$\frac{1}{16}$	$\frac{1}{14}$
$\frac{3}{10}$	$\frac{1}{6}$	$\frac{3}{10}$	$\frac{1}{12}$	$\frac{5}{12}$	$\frac{3}{8}$	$\frac{5}{12}$	$\frac{3}{16}$	$\frac{1}{14}$

Subtracting Fractions



1. Mark a sheet of paper into 8 equal parts. Shade 5 of the parts. How many eighths did you shade? Now take away 1 of the 5 eighths. How many eighths are left?

Does 4 eighths = 1 half? $\frac{4}{8} = \frac{1}{2}$

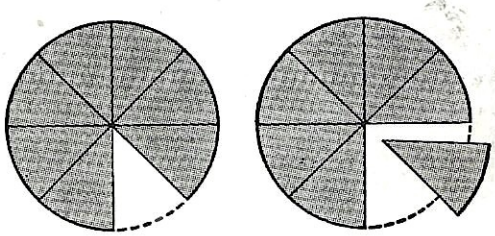
Then $\frac{5}{8} - \frac{1}{8} = \frac{4}{8}$ or $\frac{1}{2}$.

2. Look at the circle below. It is divided into 8 equal parts. How many parts are shaded? Cover 1 of the 7 eighths. How many eighths are left? Now cover 3 of the 7 eighths. How many are left?

Think

$\frac{7}{8} - \frac{1}{8} = \frac{6}{8} = \frac{6 \div 2}{8 \div 2} = \frac{3}{4}$

$\frac{7}{8} - \frac{3}{8} = \frac{4}{8} = \frac{4 \div 4}{8 \div 4} = \frac{1}{2}$



3. Fill a measuring cup $\frac{3}{4}$ full of water. Then pour $\frac{1}{4}$ of it into another measuring cup. How much water is left in the first cup?

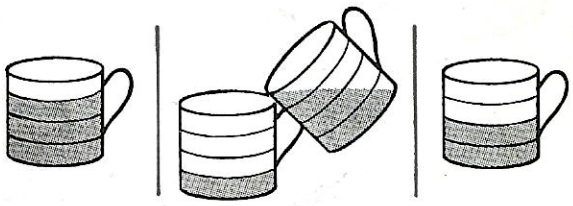
$\frac{3}{4}$

$\frac{1}{4}$

$\frac{2}{4}$ or $\frac{1}{2}$

Think

$\frac{2}{4} = \frac{2 \div 2}{4 \div 2} = \frac{1}{2}$



4. Bob lives $\frac{3}{8}$ of a mile from school, and Tom lives $\frac{1}{8}$ of a mile from school. How much farther from school does Bob live than Tom?

How much more is $\frac{3}{8}$ than $\frac{1}{8}$?

$\frac{3}{8}$

$\frac{1}{8}$

$\frac{2}{8} = \frac{1}{4}$

Subtracting Fractions

1. Subtract these fractions aloud. Be sure that you change your answer to lowest terms.

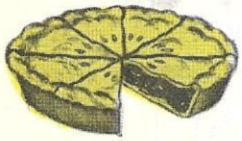
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
$\frac{3}{4}$	$\frac{5}{8}$	$\frac{5}{6}$	$\frac{5}{6}$	$\frac{3}{8}$	$\frac{7}{8}$	$\frac{7}{9}$	$\frac{4}{6}$	$\frac{9}{10}$
$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{6}$	$\frac{3}{6}$	$\frac{1}{8}$	$\frac{5}{8}$	$\frac{4}{9}$	$\frac{1}{6}$	$\frac{4}{10}$

2. Subtract and change to lowest terms:

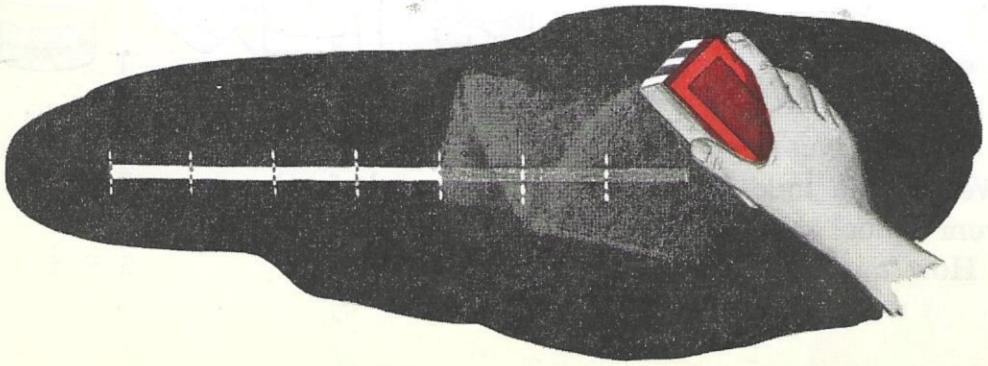
$\frac{7}{12}$	$\frac{7}{16}$	$\frac{8}{10}$	$\frac{7}{8}$	$\frac{7}{10}$	$\frac{5}{16}$	$\frac{7}{9}$	$\frac{9}{16}$	$\frac{5}{14}$
$\frac{5}{12}$	$\frac{3}{16}$	$\frac{4}{10}$	$\frac{3}{8}$	$\frac{3}{10}$	$\frac{1}{16}$	$\frac{1}{9}$	$\frac{3}{16}$	$\frac{3}{14}$

3. Beth had $\frac{2}{3}$ of a cup of milk. She used $\frac{1}{3}$ of a cup to make biscuits. How much of the milk was left?

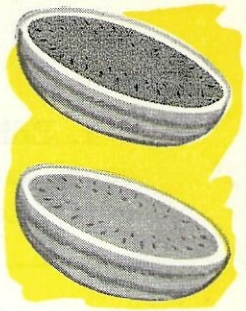
4. Mrs. Wells cut her pie into 8 equal pieces. Each piece was one eighth. There were 7 pieces left when Mary was ready to serve the pie for dinner. This was $\frac{7}{8}$ of the pie. Mary served 4 pieces, or $\frac{4}{8}$ of the pie. How many pieces were left? What part of the pie was left?



5. Jim drew a line $\frac{7}{8}$ of a foot long. Then he erased $\frac{3}{8}$ of a foot. How long was the line that was left?



Improper Fractions



1. Look at the watermelon. It has been cut into halves. How many halves are there? Let us put the 2 halves together. Are the 2 halves equal to 1 whole watermelon?

2 halves = 1 whole $\frac{2}{2} = 1$

2. The 6 halves are equal to how many whole oranges?

$\frac{6}{2} = 3$

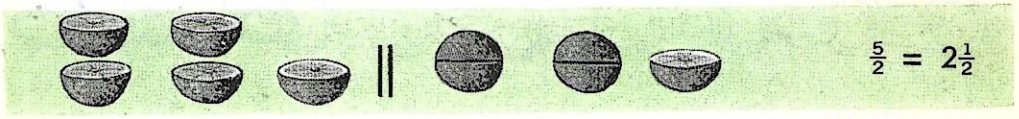
6 halves = 3 wholes

3. The picture below shows 3 half oranges. How many halves are equal to 1 whole orange? Then 3 halves are equal to 1 whole orange and a half.

$\frac{3}{2} = 1\frac{1}{2}$

3 halves = 1 whole and 1 half

4. Five halves are equal to 2 wholes and 1 half.



$\frac{5}{2} = 2\frac{1}{2}$

Fractions, as $\frac{1}{2}$ and $\frac{3}{4}$, are called **proper fractions**. They stand for, or show, parts of a whole.

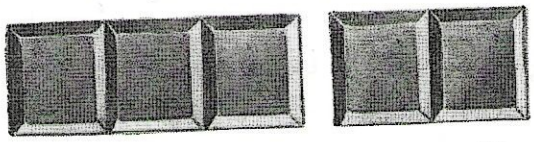
Fractions, as $\frac{2}{2}$ and $\frac{8}{8}$, or $\frac{5}{2}$ and $\frac{6}{4}$, are called **improper fractions**. Fractions which stand for, or show, a whole thing or more than a whole thing are improper fractions.

Wholes and parts written together, as $2\frac{1}{2}$ and $6\frac{1}{4}$, are called **mixed numbers**.

Fraction Sums Equal to One

1. Edith had a candy bar that was divided into 5 equal parts. She ate $\frac{3}{5}$ of the candy bar at lunch and $\frac{2}{5}$ of it after school. How much of the candy did she eat?

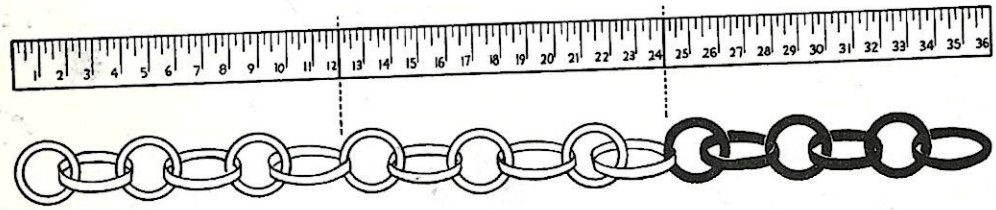
$\frac{3}{5}$
$\frac{2}{5}$
$\frac{5}{5} = 1$



Edith ate $\frac{5}{5}$ of the candy bar. She ate the whole bar, or all of it.

2. Joe and Jim each bought $\frac{1}{2}$ pound of candy. How much candy did they both buy?

3. Ruth made a chain $\frac{2}{3}$ of a yard long. Jane made a chain $\frac{1}{3}$ of a yard long. They put their chains together. How long was the new chain?

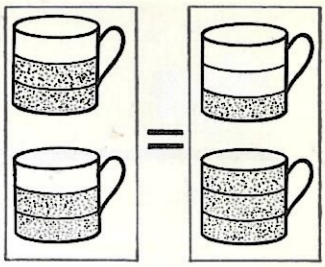


4. Sue practiced her music lesson for $\frac{4}{5}$ of an hour before lunch and for $\frac{1}{5}$ of an hour after lunch. How long did she practice altogether?

5. Add these fractions:

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{3}{5}$	$\frac{5}{8}$	$\frac{5}{12}$	$\frac{5}{16}$	$\frac{1}{9}$
$\frac{1}{2}$	$\frac{2}{3}$	$\frac{3}{4}$	$\frac{5}{6}$	$\frac{1}{6}$	$\frac{2}{5}$	$\frac{3}{8}$	$\frac{7}{12}$	$\frac{3}{16}$	$\frac{7}{9}$

Fractions and Mixed Numbers



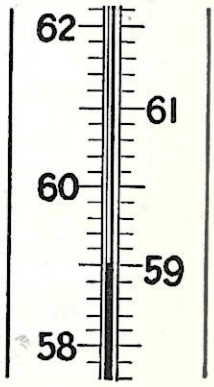
1. Alice used $\frac{2}{3}$ of a cup of brown sugar and $\frac{2}{3}$ of a cup of white sugar to make candy. How many cups of sugar did she use in all?

Look at the measuring cups. Do you see that Alice used 1 full cup and one third of another cup?

When we add $\frac{2}{3}$ and $\frac{2}{3}$, we get $\frac{4}{3}$. Then we change $\frac{4}{3}$ to the mixed number $1\frac{1}{3}$. We think, "1 whole is equal to $\frac{3}{3}$, and $\frac{4}{3}$ is one third more than $\frac{3}{3}$, or 1. $\frac{4}{3} = 1 + \frac{1}{3}$. So $\frac{4}{3}$ is equal to $1\frac{1}{3}$."

$$\begin{array}{r} \frac{2}{3} \\ \frac{2}{3} \\ \hline \frac{4}{3} = 1\frac{1}{3} \end{array}$$

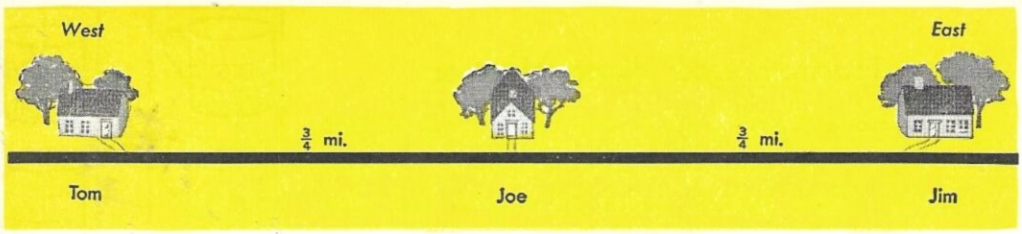
2. Henry had $\frac{4}{5}$ of a candy bar, and Elmer had $\frac{3}{5}$ of a candy bar just like it. Did they have more than 1 candy bar? How much more than 1 whole bar did they have?



3. Jack watched the big thermometer in front of the city hall. The temperature rose $\frac{2}{5}$ of a degree between 1 and 2 o'clock, and between 2 and 3 o'clock it rose $\frac{4}{5}$ of a degree. How many degrees warmer did it get in the two hours? Did it get as much as 1 degree warmer?

4. Add and change the answers to mixed numbers:

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
$\frac{4}{6}$	$\frac{4}{5}$	$\frac{5}{8}$	$\frac{2}{3}$	$\frac{6}{7}$	$\frac{5}{9}$	$\frac{4}{5}$	$\frac{3}{7}$	$\frac{7}{12}$	$\frac{5}{10}$
$\frac{3}{6}$	$\frac{2}{5}$	$\frac{6}{8}$	$\frac{2}{3}$	$\frac{5}{7}$	$\frac{5}{9}$	$\frac{4}{5}$	$\frac{6}{7}$	$\frac{6}{12}$	$\frac{6}{10}$



Changing Sums to Mixed Numbers

1. Tom, Joe, and Jim live on the same highway. Tom lives $\frac{3}{4}$ of a mile west of Joe, and Jim lives $\frac{3}{4}$ of a mile east of Joe. How far apart do Tom and Jim live?

$$\begin{array}{r} \frac{3}{4} \\ \frac{3}{4} \\ \hline \frac{6}{4} \end{array} = 1\frac{2}{4} = 1\frac{1}{2}$$

1. Add the fractions: $\frac{3}{4} + \frac{3}{4} = \frac{6}{4}$.
2. Change the improper fraction to a mixed number.

Think

$\frac{4}{4} = 1$. So $\frac{6}{4} = \frac{4}{4} + \frac{2}{4} = 1 + \frac{2}{4} = 1\frac{2}{4}$.

3. Change the fraction to lowest terms.

Think

$$\frac{2}{4} = \frac{2 \div 2}{4 \div 2} = \frac{1}{2}$$

$$4\overline{)6} \quad 1\tfrac{2}{4} \text{ or } 1\tfrac{1}{2}$$
$$\underline{4}$$
$$2$$

2. Grandmother used $\frac{7}{8}$ of a pound of butter to make cookies for a picnic and $\frac{7}{8}$ of a pound for other cookies. How much butter did she use for all the cookies?

3. Add these fractions aloud. Be sure that you change the improper fraction to a mixed number and change the fraction to lowest terms.

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
$\frac{4}{6}$	$\frac{5}{8}$	$\frac{7}{8}$	$\frac{3}{8}$	$\frac{7}{16}$	$\frac{11}{12}$	$\frac{2}{3}$	$\frac{5}{9}$	$\frac{9}{10}$
$\frac{5}{6}$	$\frac{5}{8}$	$\frac{5}{8}$	$\frac{7}{8}$	$\frac{11}{16}$	$\frac{9}{12}$	$\frac{2}{3}$	$\frac{7}{9}$	$\frac{9}{10}$

Taking a Part from a Whole

1. Jack had a whole apple. He cut it into 2 equal parts, or halves. He gave Jane $\frac{1}{2}$ of the apple, and he kept the rest for himself. What part of the apple did he keep for himself?

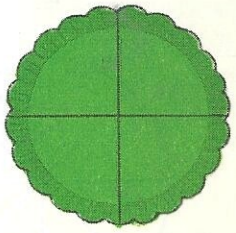
Think: 1 whole = 2 halves $\quad 1 = \frac{2}{2}$

2 halves
−1 half
1 half

$\frac{2}{2} - \frac{1}{2} = \frac{1}{2} \qquad 1 - \frac{1}{2} = \frac{1}{2}$

Jack kept $\frac{1}{2}$ of the apple.

2. Cut a paper plate into fourths. How many fourths are there? Now take away 1 of the fourths. How many fourths are left?

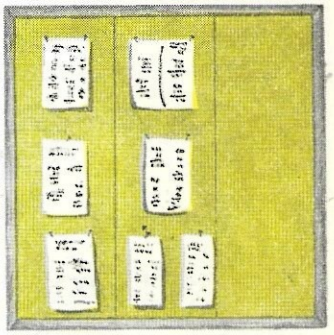


4 fourths
−1 fourth
3 fourths

$\frac{4}{4} - \frac{1}{4} = \frac{3}{4} \qquad 1 - \frac{1}{4} = \frac{3}{4}$

3. Jack, Jane, and Jerry divided the bulletin board into thirds. They used $\frac{2}{3}$ of it to display their arithmetic work and saved the rest of the space for other things. How much of the bulletin board was left for other things?

We think of the bulletin board as 1 whole, which is $\frac{3}{3}$, or all of it.



4. Subtract:

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
$\frac{6}{6}$	1	$\frac{4}{4}$	1	$\frac{5}{5}$	1	$\frac{3}{3}$	1	$\frac{8}{8}$	1
$\frac{5}{6}$	$\frac{5}{6}$	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{5}{8}$	$\frac{5}{8}$

Adding Parts of Different Sizes

1. Janet wants to buy $\frac{1}{2}$ yard of ribbon for her dress and $\frac{1}{4}$ yard of the same ribbon for her hair. How much ribbon does she need to buy?

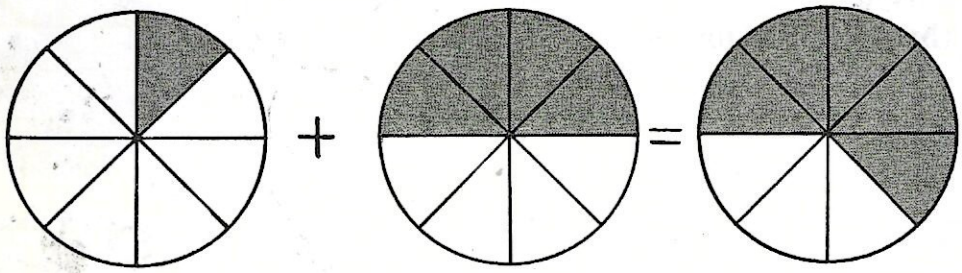
This is Janet's problem: $\frac{1}{2} + \frac{1}{4} = ?$

Think
$\frac{1}{2} = \frac{2}{4}$

Janet thought: "The parts are not the same size; so I must change them to parts of the same size. I can divide halves into fourths. One half is two fourths. Two fourths and one fourth are three fourths."

$\frac{1}{2} = \frac{2}{4}$
$\frac{1}{4} = \frac{1}{4}$
$\frac{3}{4}$

2. Use the circles to tell how we can answer this question: $\frac{1}{8} + \frac{1}{2} = ?$



3. Add orally:

(a)	(b)	(c)	(d)	(e)	(f)
$\frac{1}{2} + \frac{1}{16}$	$\frac{3}{8} + \frac{1}{16}$	$\frac{3}{8} + \frac{1}{2}$	$\frac{1}{4} + \frac{1}{8}$	$\frac{1}{4} + \frac{3}{8}$	$\frac{1}{5} + \frac{7}{10}$

4. Copy and add:

$\frac{1}{4} + \frac{1}{16}$	$\frac{3}{8} + \frac{5}{16}$	$\frac{5}{8} + \frac{3}{16}$	$\frac{3}{4} + \frac{1}{8}$	$\frac{5}{8} + \frac{1}{4}$	$\frac{1}{2} + \frac{1}{8}$

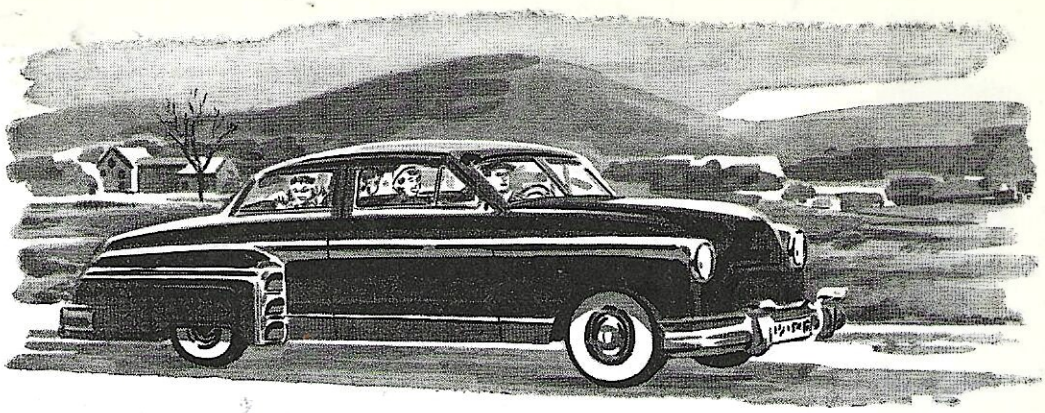
5. Check these answers. Are there any mistakes?

$\frac{3}{4} + \frac{1}{16} = \frac{12}{16} + \frac{1}{16} = \frac{13}{16}$

$\frac{3}{16} + \frac{1}{2} = \frac{3}{16} + \frac{8}{16} = \frac{11}{16}$

$\frac{1}{4} + \frac{5}{8} = \frac{2}{8} + \frac{5}{8} = \frac{7}{8}$

$\frac{1}{3} + \frac{7}{12} = \frac{4}{12} + \frac{7}{12} = \frac{11}{12}$



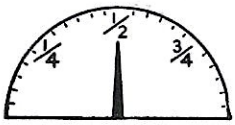
Subtracting Unlike Parts

1. Mr. Potter had $\frac{3}{4}$ of a tank of gasoline when he took the family for a ride Sunday afternoon. When they got back home, the tank was just $\frac{1}{2}$ full. What part of a tank was used?

This is the problem: $\frac{3}{4} - \frac{1}{2} = ?$

Think: One half equals two fourths.

Now the problem is: $\frac{3}{4} - \frac{2}{4} = ?$



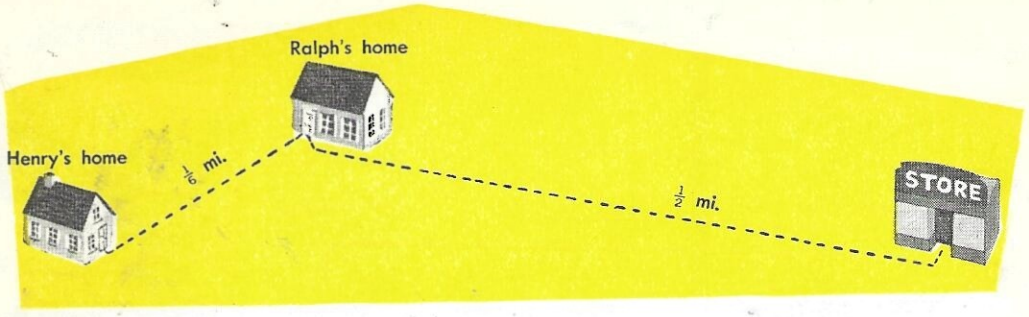
2. Subtract orally:

(*a*) $\frac{9}{16} - \frac{1}{2} = ?$ (*b*) $\frac{1}{2} - \frac{1}{4} = ?$ (*c*) $\frac{7}{8} - \frac{1}{2} = ?$

Copy and subtract:

	(*a*)	(*b*)	(*c*)	(*d*)	(*e*)	(*f*)
3.	$\frac{7}{16} - \frac{3}{8}$	$\frac{3}{8} - \frac{1}{4}$	$\frac{5}{16} - \frac{1}{4}$	$\frac{11}{16} - \frac{3}{8}$	$\frac{9}{16} - \frac{1}{2}$	$\frac{5}{9} - \frac{1}{3}$
4.	$\frac{3}{16} - \frac{1}{8}$	$\frac{7}{8} - \frac{3}{4}$	$\frac{7}{8} - \frac{1}{2}$	$\frac{5}{8} - \frac{1}{4}$	$\frac{1}{2} - \frac{1}{8}$	$\frac{11}{12} - \frac{5}{6}$
5.	$\frac{5}{8} - \frac{1}{2}$	$\frac{13}{16} - \frac{3}{4}$	$\frac{7}{8} - \frac{1}{4}$	$\frac{11}{16} - \frac{1}{2}$	$\frac{3}{5} - \frac{3}{10}$	$\frac{1}{2} - \frac{1}{6}$

6. When Alice came home from school, she saw $\frac{1}{2}$ of an apple pie on the table. She ate $\frac{1}{4}$ of the pie. How much was left?



Adding Unlike Fractions

1. Henry walked $\frac{1}{6}$ of a mile to Ralph's home and then $\frac{1}{2}$ mile farther to the store. How far did Henry walk in going from his home to the store?

$$\begin{array}{r} \frac{1}{6} = \frac{1}{6} \\ \frac{1}{2} = \frac{3}{6} \\ \hline \frac{4}{6} = \frac{2}{3} \end{array}$$

First, we change the half to sixths so that the parts will be the same size, or so that the fractions will have a common denominator.

Next, we add the number of parts, or the numerators.

Then we change the answer to lowest terms.

$$\begin{array}{r} \frac{1}{2} = \frac{2}{4} \\ \frac{3}{4} = \frac{3}{4} \\ \hline \frac{5}{4} = 1\frac{1}{4} \end{array}$$

2. Henry met Bill at the store. Bill walked from the store to Ralph's home with Henry and then $\frac{3}{4}$ mile farther to his own home. How far did Bill walk in going from the store to his home?

3. Study the examples:

A
$$\begin{array}{r} \frac{1}{2} = \frac{4}{8} \\ \frac{3}{8} = \frac{3}{8} \\ \hline \frac{7}{8} \end{array}$$

B
$$\begin{array}{r} \frac{1}{5} = \frac{2}{10} \\ \frac{3}{10} = \frac{3}{10} \\ \hline \frac{5}{10} = \frac{1}{2} \end{array}$$

C
$$\begin{array}{r} \frac{1}{2} = \frac{4}{8} \\ \frac{7}{8} = \frac{7}{8} \\ \hline \frac{11}{8} = 1\frac{3}{8} \end{array}$$

D
$$\begin{array}{r} \frac{1}{2} = \frac{3}{6} \\ \frac{5}{6} = \frac{5}{6} \\ \hline \frac{8}{6} = 1\frac{2}{6} = 1\frac{1}{3} \end{array}$$

Practice in Adding Fractions [Test]

1. Add these fractions:

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
$\frac{1}{9}$	$\frac{1}{3}$	$\frac{5}{12}$	$\frac{5}{16}$	$\frac{3}{5}$	$\frac{1}{6}$	$\frac{7}{10}$	$\frac{4}{7}$	$\frac{3}{8}$	$\frac{1}{5}$
$\frac{4}{9}$	$\frac{1}{3}$	$\frac{6}{12}$	$\frac{2}{16}$	$\frac{1}{5}$	$\frac{4}{6}$	$\frac{2}{10}$	$\frac{2}{7}$	$\frac{4}{8}$	$\frac{1}{5}$

2. Add these fractions. Be sure your answers are changed to lowest terms.

$\frac{1}{6}$	$\frac{1}{8}$	$\frac{3}{8}$	$\frac{5}{8}$	$\frac{5}{12}$	$\frac{3}{10}$	$\frac{9}{16}$	$\frac{4}{9}$	$\frac{1}{9}$	$\frac{1}{10}$
$\frac{1}{6}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{1}{8}$	$\frac{3}{12}$	$\frac{5}{10}$	$\frac{5}{16}$	$\frac{2}{9}$	$\frac{2}{9}$	$\frac{3}{10}$

3. Add these fractions. The answers will be improper fractions. Change them to mixed numbers, and change the fractions, if they can be, to lowest terms.

$\frac{2}{3}$	$\frac{3}{4}$	$\frac{1}{4}$	$\frac{5}{6}$	$\frac{7}{8}$	$\frac{7}{12}$	$\frac{5}{9}$	$\frac{4}{5}$	$\frac{7}{16}$	$\frac{7}{10}$
$\frac{2}{3}$	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{2}{6}$	$\frac{3}{8}$	$\frac{7}{12}$	$\frac{7}{9}$	$\frac{4}{5}$	$\frac{11}{16}$	$\frac{9}{10}$

4. Change to parts of the same size and add. Watch each answer. You may need to change it to lowest terms. It may be an improper fraction. You will change it to a mixed number, and maybe this fraction will need to be changed to lower terms.

$\frac{1}{3}$	$\frac{1}{5}$	$\frac{1}{2}$	$\frac{3}{10}$	$\frac{1}{10}$	$\frac{1}{2}$	$\frac{5}{6}$	$\frac{2}{3}$	$\frac{3}{4}$	$\frac{1}{4}$
$\frac{1}{6}$	$\frac{3}{10}$	$\frac{1}{6}$	$\frac{1}{2}$	$\frac{4}{5}$	$\frac{5}{8}$	$\frac{7}{12}$	$\frac{5}{9}$	$\frac{1}{2}$	$\frac{5}{12}$

5. Ann used $\frac{5}{6}$ yard of ribbon on her costume and $\frac{2}{3}$ yard of ribbon for her hair. How much ribbon did she use?

6. Tom bought $\frac{1}{2}$ pound of peanuts and $\frac{1}{4}$ pound of almonds. What part of a pound of nuts did he buy?

Subtracting Unlike Fractions

1. Tom lives $\frac{7}{8}$ of a mile from school, and Fred lives $\frac{3}{4}$ of a mile from school. How much farther does Tom walk to school than Fred?

$\frac{7}{8} = \frac{7}{8}$
$\frac{3}{4} = \frac{6}{8}$
$\frac{1}{8}$

The way to subtract $\frac{3}{4}$ from $\frac{7}{8}$ is to change the parts so that they will be the same size. If we think, "Three fourths equal six eighths," we will have no trouble.

7 eighths = 7 eighths
3 fourths = 6 eighths
1 eighth

$\frac{7}{8} - \frac{3}{4} = \frac{7}{8} - \frac{6}{8} = \frac{1}{8}$

$\frac{5}{6} = \frac{5}{6}$
$\frac{1}{2} = \frac{3}{6}$
$\frac{2}{6} = \frac{1}{3}$

What must we do before we can subtract parts of different sizes? How do we change $\frac{1}{2}$ to $\frac{3}{6}$? How do we get 3 for the numerator of $\frac{3}{6}$? Why did we use 6 as the denominator?

To change $\frac{1}{2}$ to sixths, think, "How many 2's in 6?" Then you see that the 2 must be multiplied by 3. You also multiply the numerator, 1, by the 3.

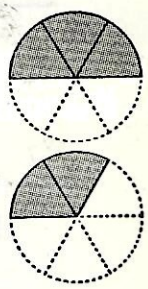
$\frac{3 \times 1}{3 \times 2} = \frac{3}{6}$

2. Change to parts of the same size and subtract:

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
$\frac{1}{2}$	$\frac{5}{6}$	$\frac{7}{9}$	$\frac{5}{6}$	$\frac{7}{8}$	$\frac{4}{9}$	$\frac{11}{12}$	$\frac{11}{12}$	$\frac{7}{10}$	$\frac{5}{8}$	$\frac{7}{9}$
$\frac{1}{6}$	$\frac{1}{2}$	$\frac{2}{3}$	$\frac{1}{3}$	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{2}{3}$	$\frac{3}{4}$	$\frac{2}{5}$	$\frac{3}{16}$	$\frac{2}{3}$

Parts of Different Sizes

After the big Thanksgiving dinner Mrs. West found $\frac{1}{2}$ of a pumpkin pie on one plate and $\frac{1}{3}$ of a pumpkin pie on another plate. She put both pieces on the same plate. How much of a pie did she have on the plate?



The way to add $\frac{1}{2}$ and $\frac{1}{3}$ is to change them to parts of the same size. We must think, "One half equals three sixths, and one third equals two sixths."

Now we can add:

1 half = 3 sixths
1 third = 2 sixths
5 sixths

$\frac{1}{2} = \frac{3}{6}$
$\frac{1}{3} = \frac{2}{6}$
$\frac{5}{6}$

$\frac{1}{2} + \frac{1}{3} = \frac{3}{6} + \frac{2}{6} = \frac{5}{6}$

Add:

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
1.	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{3}{16}$	$\frac{2}{3}$	$\frac{3}{8}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{1}{16}$	$\frac{1}{4}$	$\frac{1}{8}$
	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{3}{4}$	$\frac{1}{6}$	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{4}$
2.	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{3}$	$\frac{2}{5}$	$\frac{2}{3}$	$\frac{3}{8}$	$\frac{2}{5}$	$\frac{1}{6}$
	$\frac{1}{5}$	$\frac{1}{4}$	$\frac{3}{10}$	$\frac{1}{6}$	$\frac{1}{8}$	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{5}$

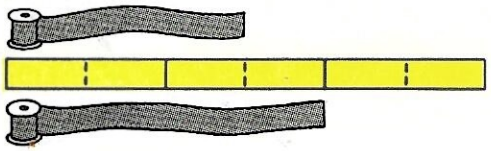
More about Adding

1. Joan had $\frac{1}{2}$ yard of tape on one spool and $\frac{2}{3}$ yard on another spool. How much tape did she have on both?

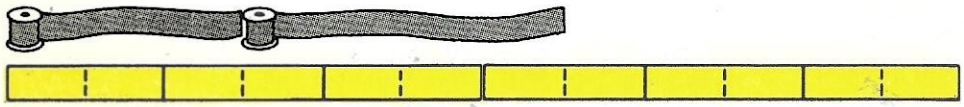
$\frac{1}{2} = \frac{3}{6}$

$\frac{2}{3} = \frac{4}{6}$

$\frac{7}{6} = 1\frac{1}{6}$



$\frac{1}{2} + \frac{2}{3} = \frac{3}{6} + \frac{4}{6} = \frac{7}{6} = 1\frac{1}{6}$



2. Walter ate $\frac{3}{4}$ of a cantaloupe, and John ate $\frac{2}{3}$ of a cantaloupe. How much did both of them eat?

3. A truck farmer set out $\frac{5}{6}$ of an acre of ground in tomatoes and $\frac{2}{3}$ of an acre in cabbage. How much ground did he plant in tomatoes and cabbage?

4. Study the examples below.

$\frac{1}{4} = \frac{3}{12}$

$\frac{1}{6} = \frac{2}{12}$

$\frac{5}{12}$

$\frac{1}{6} = \frac{5}{30}$

$\frac{9}{10} = \frac{27}{30}$

$\frac{32}{30} = 1\frac{2}{30} = 1\frac{1}{15}$

$\frac{3}{4} = \frac{15}{20}$

$\frac{3}{10} = \frac{6}{20}$

$\frac{21}{20} = 1\frac{1}{20}$

Change to parts of the same size and add:

	(a)	(b)	(c)	(d)	(e)	(f)
5.	$\frac{2}{3} + \frac{1}{2}$	$\frac{4}{5} + \frac{2}{3}$	$\frac{3}{5} + \frac{5}{6}$	$\frac{3}{4} + \frac{3}{5}$	$\frac{3}{4} + \frac{5}{8}$	$\frac{1}{4} + \frac{3}{8}$
6.	$\frac{2}{3} + \frac{5}{8}$	$\frac{5}{6} + \frac{5}{8}$	$\frac{3}{4} + \frac{2}{3}$	$\frac{3}{4} + \frac{5}{6}$	$\frac{7}{12} + \frac{2}{3}$	$\frac{5}{8} + \frac{5}{6}$
7.	$\frac{11}{12} + \frac{5}{8}$	$\frac{5}{12} + \frac{3}{4}$	$\frac{1}{6} + \frac{9}{10}$	$\frac{3}{4} + \frac{7}{8}$	$\frac{3}{4} + \frac{9}{16}$	$\frac{2}{3} + \frac{3}{7}$
8.	$\frac{7}{8} + \frac{9}{16}$	$\frac{3}{4} + \frac{7}{10}$	$\frac{9}{10} + \frac{1}{2}$	$\frac{7}{12} + \frac{3}{4}$	$\frac{5}{6} + \frac{7}{12}$	$\frac{1}{9} + \frac{1}{6}$

Working with Fractions

Subtract:

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
1.	$\frac{1}{2}$ $\frac{1}{5}$	$\frac{2}{3}$ $\frac{5}{8}$	$\frac{3}{5}$ $\frac{1}{2}$	$\frac{3}{8}$ $\frac{1}{6}$	$\frac{1}{4}$ $\frac{1}{10}$	$\frac{2}{5}$ $\frac{1}{3}$	$\frac{5}{6}$ $\frac{1}{4}$	$\frac{5}{6}$ $\frac{1}{2}$	$\frac{3}{10}$ $\frac{1}{4}$	$\frac{15}{16}$ $\frac{3}{4}$
2.	$\frac{3}{4}$ $\frac{5}{12}$	$\frac{1}{4}$ $\frac{1}{6}$	$\frac{3}{4}$ $\frac{2}{3}$	$\frac{5}{6}$ $\frac{5}{8}$	$\frac{9}{10}$ $\frac{1}{5}$	$\frac{3}{4}$ $\frac{3}{10}$	$\frac{1}{6}$ $\frac{1}{8}$	$\frac{9}{10}$ $\frac{3}{4}$	$\frac{11}{12}$ $\frac{1}{4}$	$\frac{3}{4}$ $\frac{1}{6}$

Add:

3.	$\frac{3}{5}$ $\frac{3}{5}$	$\frac{1}{6}$ $\frac{1}{8}$	$\frac{2}{3}$ $\frac{1}{6}$	$\frac{5}{8}$ $\frac{5}{8}$	$\frac{1}{2}$ $\frac{1}{5}$	$\frac{5}{6}$ $\frac{1}{8}$	$\frac{3}{4}$ $\frac{7}{8}$	$\frac{2}{5}$ $\frac{3}{10}$	$\frac{7}{8}$ $\frac{5}{16}$	$\frac{3}{4}$ $\frac{1}{6}$
4.	$\frac{5}{6}$ $\frac{3}{4}$	$\frac{1}{4}$ $\frac{1}{8}$	$\frac{1}{3}$ $\frac{3}{5}$	$\frac{1}{6}$ $\frac{7}{12}$	$\frac{1}{4}$ $\frac{1}{3}$	$\frac{1}{3}$ $\frac{5}{8}$	$\frac{1}{4}$ $\frac{5}{6}$	$\frac{2}{3}$ $\frac{3}{8}$	$\frac{3}{4}$ $\frac{1}{10}$	$\frac{2}{9}$ $\frac{1}{6}$

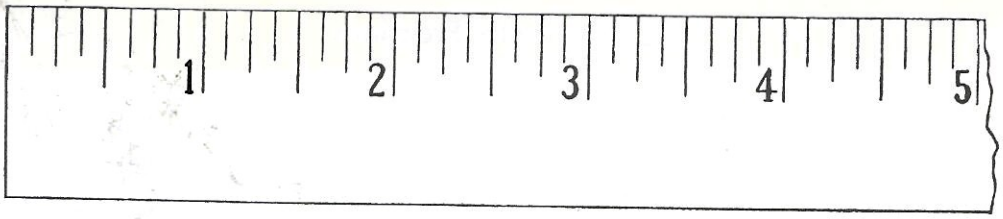
5. Mrs. West used $\frac{3}{4}$ dozen eggs for cookies and $\frac{2}{3}$ dozen eggs for a cake. How many dozen eggs did she use?

6. Martha washes the breakfast and dinner dishes. It takes her about $\frac{1}{4}$ of an hour to wash the breakfast dishes and $\frac{1}{2}$ hour to do the dinner dishes. About how long does it take her to wash the dishes each day?

7. Alice is learning to cook. The recipe she is using reads: "Pour $\frac{1}{2}$ cup of milk into the sugar and stir. Then add $\frac{3}{4}$ cup of milk and stir again." How much milk does Alice need for the recipe?

$$\begin{array}{r} \frac{2}{3} = \frac{4}{6} \\ -\frac{1}{2} = \frac{3}{6} \\ \hline \frac{1}{6} \end{array}$$

8. Alice poured $\frac{1}{3}$ cup of vinegar into $\frac{1}{2}$ cup of water. How much liquid was in the cup?



Fractions on Your Ruler

This is the picture of a part of a ruler. The part is 5 inches long. Each inch is divided into different-sized parts. The long lines divide each inch into halves; the middle-sized lines divide each inch into fourths; and the short lines divide each inch into eighths.

In each inch there are how many halves?

In each inch there are how many fourths?

In each inch there are how many eighths?

"I can add and subtract on my ruler," said Ann. "I drew a picture of my ruler and marked off the part inches as well as the whole inches. So I can tell the different-sized parts.

"To add $\frac{1}{2}$ and $\frac{3}{8}$, for example, I go out to the $\frac{1}{2}$-inch mark. Then I count $\frac{1}{8}$, $\frac{2}{8}$, $\frac{3}{8}$ farther, and there I am at $\frac{7}{8}$. So I know that $\frac{1}{2} + \frac{3}{8} = \frac{7}{8}$.

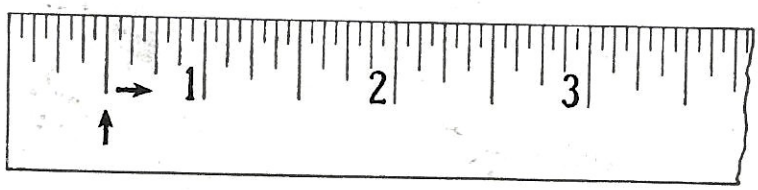
"To subtract $\frac{1}{2}$ from $\frac{7}{8}$, I start at the $\frac{7}{8}$-inch mark, and count back $\frac{4}{8}$, which is $\frac{1}{2}$, like this: $\frac{6}{8}$, $\frac{5}{8}$, $\frac{4}{8}$, $\frac{3}{8}$. And there I am at $\frac{3}{8}$. So $\frac{7}{8} - \frac{1}{2} = \frac{3}{8}$.

"To subtract on your ruler, you have to be careful where you start. To add, you go to the right. To subtract, you go to the left."

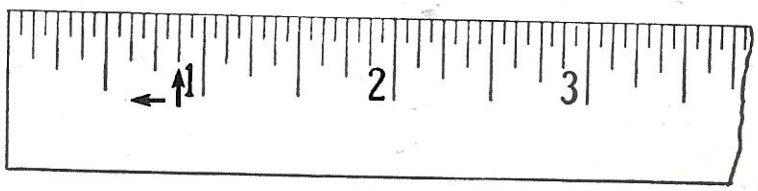
Use your ruler or the picture:

Find and point to:	*Move on:*	*Where are you?*	*Write:*
$\frac{1}{2}$-inch mark	$\frac{1}{4}$ inch	*three fourths*	$\frac{1}{2} + \frac{1}{4} = \frac{3}{4}$
1 -inch mark	$\frac{3}{4}$ inch		$1 + \frac{3}{4} = ?$
$1\frac{1}{2}$-inch mark	$\frac{3}{8}$ inch		$1\frac{1}{2} + \frac{3}{8} = ?$
$1\frac{3}{4}$-inch mark	1 inch		$1\frac{3}{4} + 1 = ?$
$1\frac{3}{4}$-inch mark	$\frac{1}{2}$ inch		$1\frac{3}{4} + \frac{1}{2} = ?$

Find and point to:	*Move back:*	*Where are you?*	*Write:*
$\frac{1}{2}$-inch mark	$\frac{1}{4}$ inch	*one fourth*	$\frac{1}{2} - \frac{1}{4} = \frac{1}{4}$
1 -inch mark	$\frac{3}{4}$ inch		$1 - \frac{3}{4} = ?$
$\frac{3}{4}$-inch mark	$\frac{3}{8}$ inch		$\frac{3}{4} - \frac{3}{8} = ?$
$1\frac{3}{4}$-inch mark	$\frac{1}{2}$ inch		$1\frac{3}{4} - \frac{1}{2} = ?$
$2\frac{1}{2}$-inch mark	$\frac{3}{4}$ inch		$2\frac{1}{2} - \frac{3}{4} = ?$
$2\frac{3}{4}$-inch mark	1 inch		$2\frac{3}{4} - 1 = ?$
$2\frac{3}{4}$-inch mark	$1\frac{1}{2}$ inch		$2\frac{3}{4} - 1\frac{1}{2} = ?$



$\frac{1}{2} + \frac{1}{4} = \frac{3}{4}$



$\frac{7}{8} - \frac{1}{4} = \frac{5}{8}$

Use your ruler to find:

$\frac{1}{4} + \frac{3}{4} = ?$ $\frac{3}{4} - \frac{1}{4} = ?$ $\frac{1}{4} + \frac{3}{8} = ?$ $\frac{7}{8} - \frac{1}{2} = ?$

Chapter 13
Mixed Numbers

Fractions and Whole Numbers

The fifth-grade girls are having a candy sale at school.

1. Mrs. Wells bought a 2-pound box of fudge and a $\frac{1}{2}$-pound box of sea foam. How many pounds of candy did she buy?

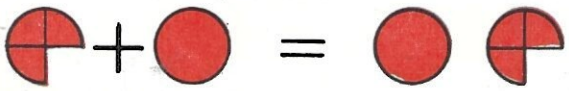
$$\begin{array}{r} 2 \\ +\ \frac{1}{2} \\ \hline 2\frac{1}{2} \end{array}$$

How do we add a whole number and a fraction?

2. Jane worked at the candy counter $\frac{3}{4}$ of an hour in the morning and 1 hour in the afternoon. How long did she work at the candy counter?

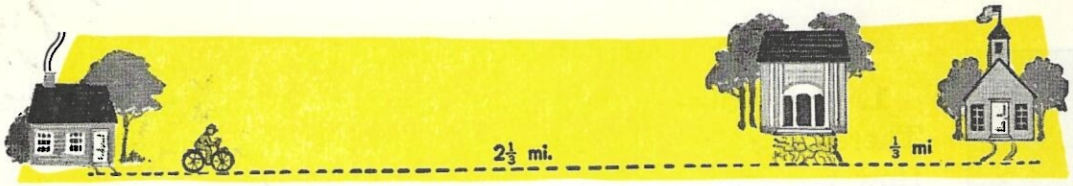
$$\begin{array}{r} \frac{3}{4} \\ +\ 1 \\ \hline 1\frac{3}{4} \end{array}$$

How do we add a fraction and a whole number?



3. Copy and add:

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
10	1	4	$3\frac{3}{8}$	5	16	8	5	$1\frac{1}{2}$
$+\ \frac{2}{3}$	$+\ 6\frac{2}{3}$	$+\ \frac{1}{3}$	$+\ 5$	$+\ \frac{1}{8}$	$+\ \frac{7}{8}$	$+\ 2\frac{3}{4}$	$+\ \frac{3}{10}$	$+\ 5$



Adding Mixed Numbers and Fractions

1. Jim rides his bicycle to school. It is $2\frac{1}{3}$ miles from his home to the courthouse and $\frac{1}{3}$ of a mile farther to school. How far is it from Jim's home to school?

$$\begin{array}{r} 2\frac{1}{3} \\ \frac{1}{3} \\ \hline 2\frac{2}{3} \end{array}$$

2. Mrs. Allen needs $2\frac{1}{4}$ cups of sugar for a cake and $\frac{1}{4}$ of a cup for the filling. How many cups of sugar does she need?

$$\begin{array}{r} 2\frac{1}{4} \\ \frac{1}{4} \\ \hline 2\frac{2}{4} = 2\frac{1}{2} \end{array}$$

Study these examples. Tell how they were added.

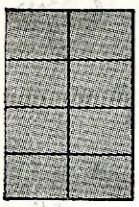
$$\begin{array}{r} \frac{2}{3} \\ 9\frac{2}{3} \\ \hline 9\frac{4}{3} = 10\frac{1}{3} \end{array} \qquad \begin{array}{r} 8\frac{3}{4} \\ \frac{3}{4} \\ \hline 8\frac{6}{4} = 9\frac{2}{4} = 9\frac{1}{2} \end{array} \qquad \begin{array}{r} 6\frac{1}{2} \\ \frac{1}{2} \\ \hline 6\frac{2}{2} = 7 \end{array}$$

3. Jack caught a fish that weighed $\frac{3}{4}$ of a pound. Then he caught another fish that weighed $1\frac{1}{4}$ pounds. How many pounds of fish had he?

4. Tom went to the store for his mother. He bought a 5-pound sack of sugar and $3\frac{1}{2}$ pounds of rice. How many pounds did the two packages weigh?

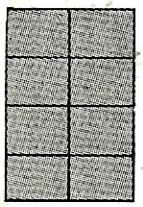
5. Copy and add:

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
$\frac{1}{8}$	$\frac{4}{5}$	$5\frac{5}{9}$	$\frac{5}{8}$	$\frac{11}{12}$	$18\frac{1}{4}$	$4\frac{1}{5}$	$8\frac{1}{4}$	$7\frac{1}{3}$
$3\frac{7}{8}$	$4\frac{4}{5}$	$\frac{8}{9}$	$6\frac{3}{8}$	$6\frac{5}{12}$	$\frac{3}{4}$	$\frac{3}{5}$	$\frac{1}{4}$	$\frac{2}{3}$

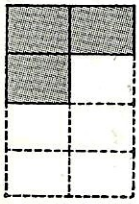


Adding Mixed Numbers

1. Tom walks $1\frac{1}{5}$ miles from his home to the highway. There he takes the bus and rides $4\frac{3}{5}$ miles to school. How far does Tom live from school?



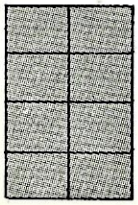
First, add the fractions.	$1\frac{1}{5}$
Next, add the whole numbers.	$4\frac{3}{5}$
	$5\frac{4}{5}$



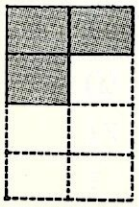
2. Jack went to the cupboard for candy for himself and the friends who were visiting him. In one box he found $2\frac{3}{8}$ chocolate bars, and in another box he found $1\frac{3}{8}$ bars. How much candy did he find in all?

3. Mrs. Burns needs $1\frac{1}{3}$ cups of flour for a pie and $4\frac{1}{3}$ cups of flour for rolls. How many cups of flour does she need?

4. Jack collected tin cans and old paper to sell. He started to work at 9 o'clock and worked until 11:30. Then he worked $1\frac{1}{2}$ hours after lunch. How many hours was that?



5. One piece of curtain material was $3\frac{1}{3}$ yards long; another piece was $1\frac{1}{3}$ yards long. Jane sewed the two pieces together. How long was the material then?



6. Add these mixed numbers:

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
$5\frac{1}{5}$	$4\frac{1}{8}$	$8\frac{1}{3}$	$3\frac{3}{5}$	$5\frac{4}{7}$	$10\frac{2}{5}$	$12\frac{5}{12}$	$5\frac{3}{7}$	$17\frac{1}{9}$
$7\frac{2}{5}$	$6\frac{3}{8}$	$4\frac{1}{3}$	$8\frac{1}{5}$	$3\frac{2}{7}$	$6\frac{2}{5}$	$14\frac{5}{12}$	$25\frac{3}{7}$	$6\frac{2}{9}$

Watch the Sum

1. On two Saturdays Joe and Jim worked to build a house for their dog. They worked $6\frac{1}{2}$ hours one Saturday and $4\frac{1}{2}$ hours the next Saturday. How many hours did they work on the two Saturdays?

$$\begin{array}{r} 6\frac{1}{2} \\ 4\frac{1}{2} \\ \hline 10\frac{2}{2} = 11 \end{array}$$

2. Joe mowed the lawn for Mr. Brown. It took him $2\frac{1}{2}$ hours to cut the grass and $\frac{1}{2}$ hour to clip the grass along the sidewalk. How many hours did Jack work?

3. Joe needs $2\frac{1}{4}$ yards of canvas to make a skate sail for himself and $1\frac{1}{4}$ yards to make one for his sister. How many yards of canvas does he need for both sails?

$$\begin{array}{r} 2\frac{1}{4} \\ 1\frac{1}{4} \\ \hline 3\frac{2}{4} = 3\frac{1}{2} \end{array}$$

4. Betty lives $5\frac{1}{2}$ blocks from the post office. How far must she walk in going to the post office and back home?

5. Copy and add. Change the sum of the fractions to lowest terms.

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
$16\frac{1}{4}$	$3\frac{1}{4}$	$5\frac{1}{4}$	$6\frac{1}{2}$	$12\frac{2}{9}$	$15\frac{2}{9}$	$8\frac{1}{8}$	$14\frac{3}{10}$	$1\frac{1}{8}$
$20\frac{1}{4}$	$6\frac{3}{4}$	$3\frac{1}{4}$	$8\frac{1}{2}$	$30\frac{4}{9}$	$10\frac{1}{9}$	$7\frac{1}{8}$	$5\frac{7}{10}$	$3\frac{3}{8}$

Adding Mixed Numbers

$$\begin{array}{r} 8\frac{1}{4} \\ 6\frac{1}{4} \\ \hline 14\frac{2}{4} = 14\frac{1}{2} \end{array}$$

1. Harry rode his bicycle $8\frac{1}{4}$ miles in the morning and $6\frac{1}{4}$ miles in the afternoon. How far did he ride his bicycle that day?

2. "I have gained $3\frac{1}{4}$ pounds," said Alice. "When school closed in June, I weighed $65\frac{3}{4}$ pounds. How much do I weigh now?"

3. Harry sold $3\frac{1}{3}$ pounds of old paper one week and $10\frac{2}{3}$ pounds the next week. How many pounds of old paper did he sell in the two weeks?

4. Betty used $1\frac{1}{4}$ cups of water and $2\frac{3}{4}$ cups of milk in a pudding. How much milk and water together did she use?

5. Betty baked some fruitcakes. She used $3\frac{3}{8}$ pounds of pecans and $2\frac{3}{8}$ pounds of walnuts. How many pounds of nuts did she use?

6. Explain these examples:

$$\begin{array}{r} 4\frac{1}{5} \\ 5\frac{1}{5} \\ \hline 9\frac{2}{5} \end{array} \qquad \begin{array}{r} 12\frac{1}{4} \\ 16\frac{3}{4} \\ \hline 28\frac{4}{4} = 29 \end{array} \qquad \begin{array}{r} 6\frac{2}{3} \\ 5\frac{2}{3} \\ \hline 11\frac{4}{3} = 12\frac{1}{3} \end{array} \qquad \begin{array}{r} 5\frac{3}{4} \\ 2\frac{3}{4} \\ \hline 7\frac{6}{4} = 8\frac{2}{4} = 8\frac{1}{2} \end{array}$$

Add. Remember to change your answers to lowest terms.

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
7.	$12\frac{1}{8}$	$2\frac{1}{3}$	$13\frac{1}{2}$	$4\frac{4}{5}$	$4\frac{5}{8}$	$9\frac{5}{16}$	$12\frac{3}{16}$	$3\frac{5}{8}$
	$16\frac{3}{8}$	$14\frac{2}{3}$	$14\frac{1}{2}$	$3\frac{2}{5}$	$6\frac{5}{8}$	$11\frac{1}{16}$	$6\frac{6}{16}$	$1\frac{1}{8}$
8.	$16\frac{3}{4}$	$6\frac{9}{16}$	$18\frac{7}{8}$	$14\frac{1}{9}$	$15\frac{1}{6}$	$16\frac{5}{12}$	$12\frac{3}{10}$	$7\frac{1}{3}$
	$9\frac{3}{4}$	$7\frac{9}{16}$	$6\frac{7}{8}$	$10\frac{2}{9}$	$8\frac{5}{6}$	$9\frac{1}{12}$	$15\frac{2}{10}$	$8\frac{2}{3}$

Subtracting Mixed Numbers

Jane, Ellen, and Susan were making dresses for their dolls.

1. Jane had 1 yard of goods. She used $\frac{3}{8}$ yard.

2. Ellen had $1\frac{5}{8}$ yards of goods. She used $\frac{3}{8}$ yard.

3. Susan had $1\frac{3}{8}$ yards of goods. She used $\frac{5}{8}$ yard.

How much goods had each girl left?

$$1 = \frac{8}{8} \qquad 1\frac{5}{8} \qquad 1\frac{3}{8} = \frac{11}{8}$$
$$\underline{\frac{3}{8}} \qquad \underline{\frac{3}{8}} \qquad \underline{\frac{5}{8}} = \underline{\frac{5}{8}}$$
$$\frac{5}{8} \qquad 1\frac{2}{8} = 1\frac{1}{4} \qquad \frac{6}{8} = \frac{3}{4}$$

Jane had 1 yard, or $\frac{8}{8}$ yard. When she used $\frac{3}{8}$ yard, she had $\frac{5}{8}$ yard left.

Ellen used $\frac{3}{8}$ yard of her $1\frac{5}{8}$ yards; so she had $1\frac{2}{8}$ yards left. Since $\frac{2}{8} = \frac{1}{4}$, she had $1\frac{1}{4}$ yards left.

Susan had $1\frac{3}{8}$ yards. $1\frac{3}{8} = \frac{8}{8} + \frac{3}{8} = \frac{11}{8}$ yards. When she used $\frac{5}{8}$ yard, she had $\frac{6}{8}$ yard left. Since $\frac{6}{8} = \frac{3}{4}$, she had $\frac{3}{4}$ yard left.

Taking a Whole Number from a Mixed Number

$25\frac{1}{2}$
18
$7\frac{1}{2}$

1. Jim needed a strip of wood 18 inches long for his kite. He had a strip of wood that was $25\frac{1}{2}$ inches long. He sawed the board in two. He kept the board that was 18 inches long and threw the other piece away. How long was the piece that he threw away?

2. Jane's mother bought $4\frac{1}{4}$ yards of dress goods. She used 3 yards to make a dress for herself. How much cloth did she have left?

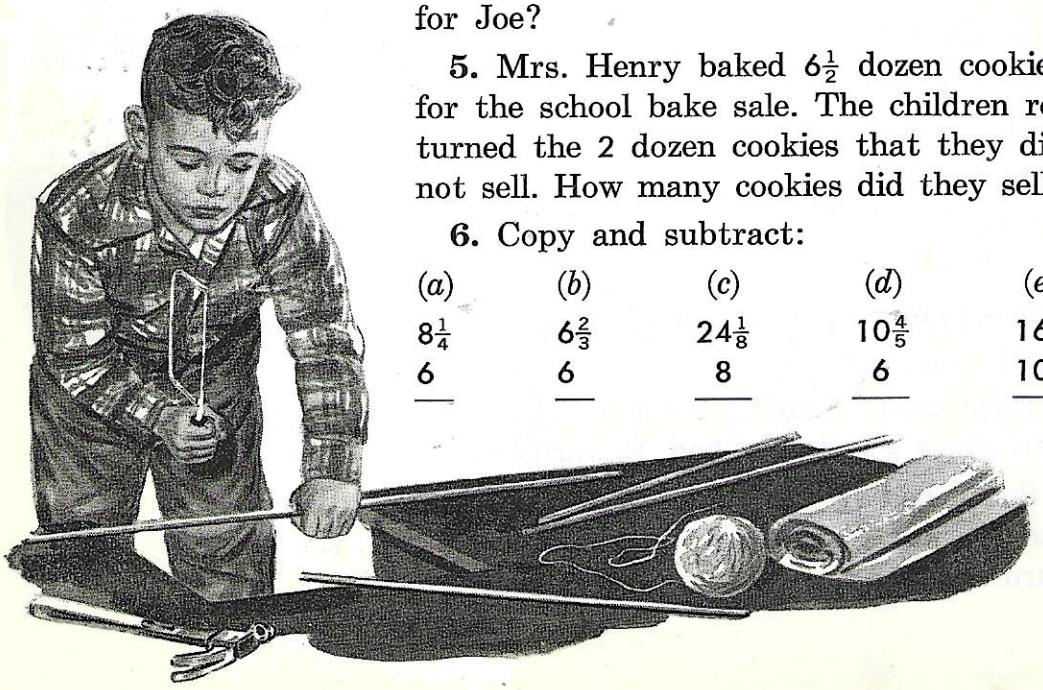
3. Jack and some other Boy Scouts went on a hike. They walked $8\frac{3}{4}$ miles to Clear Lake. They came back home by a new road. It was only 8 miles by this road. How much shorter was one road than the other?

4. Jim and Joe gathered $4\frac{1}{4}$ bushels of pecans. Jim took 2 bushels and left the rest for Joe. How many bushels were left for Joe?

5. Mrs. Henry baked $6\frac{1}{2}$ dozen cookies for the school bake sale. The children returned the 2 dozen cookies that they did not sell. How many cookies did they sell?

6. Copy and subtract:

(*a*)	(*b*)	(*c*)	(*d*)	(*e*)
$8\frac{1}{4}$	$6\frac{2}{3}$	$24\frac{1}{8}$	$10\frac{4}{5}$	$16\frac{7}{8}$
6	6	8	6	10



Subtracting Mixed Numbers

1. Bill and Tom have bicycles with cyclometers on them. Saturday Bill rode his bicycle $9\frac{5}{10}$ miles, and Tom rode his bicycle $7\frac{2}{10}$ miles. Bill rode his bicycle how much farther than Tom rode his?

$$\begin{array}{r} 9\frac{5}{10} \\ 7\frac{2}{10} \\ \hline 2\frac{3}{10} \end{array}$$

2. Jack Smith ran the 50-yard dash in $9\frac{8}{10}$ seconds, and Tom Brown ran it in $8\frac{2}{10}$ seconds. How much faster did Tom run than Jack?

$$\begin{array}{r} 9\frac{8}{10} \\ 8\frac{2}{10} \\ \hline 1\frac{6}{10} = 1\frac{3}{5} \end{array}$$

3. Mary found two dress patterns that she liked. One pattern called for $2\frac{5}{8}$ yards of cloth, and the other called for $2\frac{3}{8}$ yards. How much more cloth did the one pattern call for than the other?

$$\begin{array}{r} 2\frac{5}{8} \\ 2\frac{3}{8} \\ \hline \frac{2}{8} = \frac{1}{4} \end{array}$$

4. Jane had $8\frac{3}{4}$ yards of cloth. She used $4\frac{1}{4}$ yards to make her costume for the play. How many yards of cloth did she have left? Did she have enough left to make another costume?

5. Henry's father is $71\frac{7}{8}$ inches tall, and Henry is $54\frac{3}{8}$ inches tall. Henry's father is how much taller?

6. Mary bought $6\frac{1}{2}$ yards of lace for her dress. She used $4\frac{1}{2}$ yards of the lace. How much lace did she have left?

$$\begin{array}{r} 6\frac{1}{2} \\ 4\frac{1}{2} \\ \hline 2 \end{array}$$

7. One book weighs $3\frac{5}{16}$ pounds. Another weighs $1\frac{1}{16}$ pounds. What is the difference in weight between the two books?

8. Subtract these mixed numbers:

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
$15\frac{3}{4}$	$9\frac{3}{4}$	$10\frac{2}{3}$	$16\frac{7}{8}$	$12\frac{4}{5}$	$9\frac{5}{6}$	$12\frac{5}{7}$	$7\frac{7}{12}$	$9\frac{7}{9}$
$6\frac{3}{4}$	$6\frac{1}{4}$	$6\frac{1}{3}$	$8\frac{3}{8}$	$12\frac{1}{5}$	$2\frac{1}{6}$	$8\frac{3}{7}$	$7\frac{5}{12}$	$3\frac{4}{9}$

Mixed Numbers from Whole Numbers

1. Jack picked 8 bushels of apples, and Jane picked $3\frac{1}{2}$ bushels. How many more bushels of apples did Jack pick than Jane?

$$\begin{array}{r} 8 = 7\frac{2}{2} \\ 3\frac{1}{2} = 3\frac{1}{2} \\ \hline 4\frac{1}{2} \end{array}$$

There are no parts to subtract $\frac{1}{2}$ from. We must use one of the wholes in 8. 1 whole = 2 halves, or $1 = \frac{2}{2}$; so $8 = 7\frac{2}{2}$. Now we can subtract $3\frac{1}{2}$ from $7\frac{2}{2}$.

2. Susan picked 1 bushel of apples, and little June picked $\frac{3}{4}$ of a bushel. Susan said, "I picked one fourth of a bushel more than June picked."

Was Susan right?

3. Copy and subtract:

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
5	16	7	8	10	14	5	16
$1\frac{1}{4}$	$11\frac{2}{3}$	$2\frac{5}{8}$	$5\frac{3}{10}$	$8\frac{3}{4}$	$6\frac{7}{8}$	$4\frac{1}{3}$	$5\frac{3}{5}$

Subtracting Mixed Numbers

1. Jack rode his bicycle $4\frac{1}{5}$ miles to deliver the morning papers and $2\frac{3}{5}$ miles to deliver the evening papers. How much farther did he ride in the morning than in the afternoon?

> We cannot subtract $\frac{3}{5}$ from $\frac{1}{5}$. We use one of the 4 wholes. $1 = \frac{5}{5}$; so $4\frac{1}{5} = 3\frac{6}{5}$. Now subtract the fraction. Then subtract the whole number.
>
> $4\frac{1}{5} = 3\frac{6}{5}$
> $2\frac{3}{5} = 2\frac{3}{5}$
> $1\frac{3}{5}$

2. Paul is $57\frac{1}{4}$ inches tall, and Ray is $53\frac{3}{4}$ inches tall. How much taller is Paul than Ray?

$57\frac{1}{4} = 56\frac{5}{4}$
$53\frac{3}{4} = 53\frac{3}{4}$
$3\frac{2}{4} = 3\frac{1}{2}$

3. A box of apples weighs $50\frac{3}{10}$ pounds. The empty box weighs $2\frac{5}{10}$ pounds. How much do the apples weigh?

4. Jane weighs $64\frac{1}{2}$ pounds with her coat on. The coat weighs $2\frac{7}{8}$ pounds. How much does Jane weigh with her coat off?

5. Jim drew a line $8\frac{3}{8}$ inches long. Then he erased $5\frac{7}{8}$ inches of it. How long was the line left on the board?

6. Tim jumped $4\frac{1}{2}$ feet, and Joel jumped $3\frac{3}{4}$ feet. How much farther did Tim jump than Joel?

7. Copy and subtract:

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
$10\frac{1}{8}$	$6\frac{1}{6}$	$18\frac{3}{10}$	$16\frac{1}{3}$	$8\frac{4}{9}$	$11\frac{1}{12}$	$12\frac{3}{16}$	$8\frac{1}{8}$	$7\frac{1}{10}$
$3\frac{3}{8}$	$2\frac{5}{6}$	$7\frac{5}{10}$	$8\frac{2}{3}$	$7\frac{5}{9}$	$5\frac{5}{12}$	$8\frac{7}{16}$	$4\frac{5}{8}$	$3\frac{7}{10}$

Adding Mixed Numbers and Fractions

1. Study these examples. Explain each example:

$$\begin{array}{r} 1\frac{1}{4} = 1\frac{1}{4} \\ \underline{\frac{1}{2} = \frac{2}{4}} \\ 1\frac{3}{4} \end{array} \qquad \begin{array}{r} \frac{1}{2} = \frac{3}{6} \\ \underline{4\frac{1}{6} = 4\frac{1}{6}} \\ 4\frac{4}{6} = 4\frac{2}{3} \end{array} \qquad \begin{array}{r} 7\frac{3}{4} = 7\frac{3}{4} \\ \underline{\frac{1}{2} = \frac{2}{4}} \\ 7\frac{5}{4} = 8\frac{1}{4} \end{array} \qquad \begin{array}{r} 5\frac{1}{2} = 5\frac{3}{6} \\ \underline{\frac{5}{6} = \frac{5}{6}} \\ 5\frac{8}{6} = 6\frac{2}{6} = 6\frac{1}{3} \end{array}$$

2. Jane made her dress for the school play. She used $1\frac{1}{4}$ yards of green cloth and $\frac{1}{2}$ yard of red cloth. How many yards of cloth did she use to make the dress?

3. David worked $4\frac{1}{2}$ hours pulling weeds from Mr. West's lawn, but he did not finish the job. He had to go back the next day. It took him $\frac{1}{4}$ of an hour to finish. How many hours did David work?

4. Mrs. West bought $\frac{1}{2}$-pound of bacon and a roast that weighed $5\frac{3}{4}$ pounds. How much meat did she buy?

5. How much ribbon is $2\frac{1}{8}$ yards and $\frac{7}{8}$ yard?

6. Mrs. West needs $2\frac{3}{4}$ yards of silk to line Jane's coat. She can buy two remnants at a low price. One piece has $\frac{3}{4}$ yard, and the other has $1\frac{1}{2}$ yards. Will these two pieces be enough?

7. Add: 2 hours, $\frac{1}{2}$ hour, and $\frac{1}{2}$ hour.

Add:

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
8.	$3\frac{5}{8}$	$6\frac{11}{16}$	$\frac{1}{2}$	$12\frac{1}{3}$	$6\frac{2}{3}$	$\frac{1}{2}$	$6\frac{1}{5}$	$4\frac{1}{2}$	$1\frac{1}{6}$
	$\frac{7}{16}$	$\frac{1}{2}$	$8\frac{11}{12}$	$\frac{8}{9}$	$\frac{5}{9}$	$4\frac{9}{16}$	$\frac{9}{10}$	$\frac{3}{4}$	$\frac{8}{18}$
9.	$4\frac{2}{3}$	$6\frac{1}{8}$	$5\frac{3}{4}$	$6\frac{3}{4}$	$8\frac{3}{8}$	$7\frac{3}{4}$	$6\frac{7}{8}$	$9\frac{1}{3}$	$2\frac{3}{10}$
	$\frac{7}{12}$	$\frac{15}{16}$	$\frac{5}{12}$	$\frac{3}{16}$	$\frac{13}{16}$	$\frac{9}{16}$	$\frac{1}{4}$	$2\frac{5}{12}$	$\frac{4}{5}$

Adding Mixed Numbers and Fractions

1. Explain these examples:

$$\begin{array}{r} 8\frac{1}{2} = 8\frac{5}{10} \\ \frac{2}{5} = \frac{4}{10} \\ \hline 8\frac{9}{10} \end{array} \qquad \begin{array}{r} 9\frac{1}{2} = 9\frac{5}{10} \\ \frac{3}{5} = \frac{6}{10} \\ \hline 9\frac{11}{10} = 10\frac{1}{10} \end{array} \qquad \begin{array}{r} \frac{1}{6} = \frac{8}{48} \\ 8\frac{5}{16} = 8\frac{15}{48} \\ \hline 8\frac{23}{48} \end{array}$$

$$\begin{array}{r} 7\frac{2}{15} = 7\frac{4}{30} \\ \frac{1}{6} = \frac{5}{30} \\ \hline 7\frac{9}{30} = 7\frac{3}{10} \end{array} \qquad \begin{array}{r} \frac{5}{8} = \frac{15}{24} \\ 7\frac{7}{12} = 7\frac{14}{24} \\ \hline 7\frac{29}{24} = 8\frac{5}{24} \end{array} \qquad \begin{array}{r} \frac{7}{10} = \frac{21}{30} \\ 2\frac{7}{15} = 2\frac{14}{30} \\ \hline 2\frac{35}{30} = 3\frac{5}{30} = 3\frac{1}{6} \end{array}$$

2. Jack's jumping rope was $8\frac{1}{2}$ feet long before he tied on a piece 3 feet long. How long was the rope then?

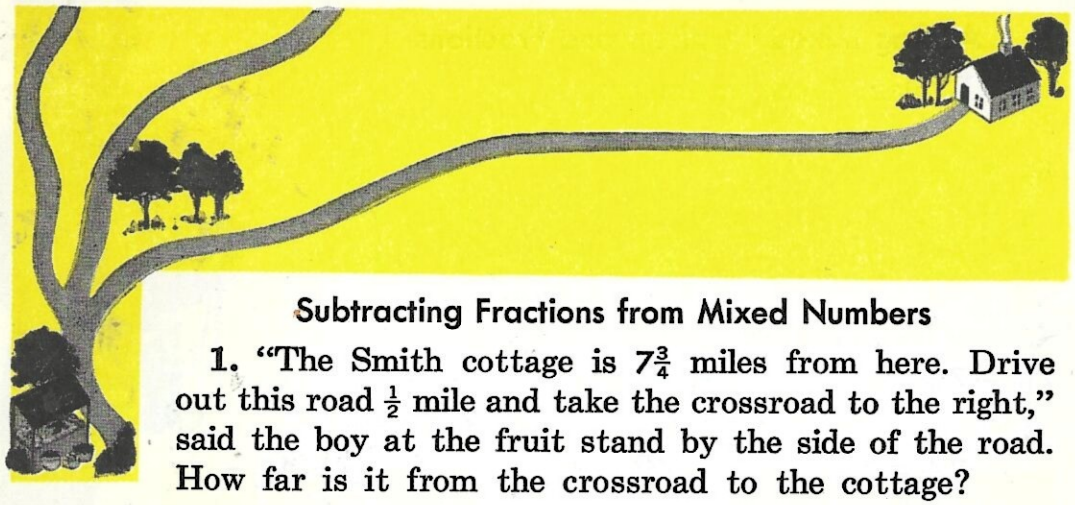
3. Alice's mother bought 2 pieces of cloth at the remnant sale. She bought $\frac{1}{4}$ yard in one piece and $2\frac{1}{6}$ yards in another piece. How many yards of cloth did she buy?

4. Find the answers:

(a)	(b)	(c)	(d)	(e)
$\frac{1}{2} + 5\frac{1}{4} =$	$3\frac{1}{2} + \frac{1}{8} =$	$2\frac{1}{12} + \frac{1}{2} =$	$8\frac{5}{12} + \frac{2}{3} =$	$6\frac{1}{4} + \frac{3}{8} =$
$\frac{3}{8} + 8\frac{1}{2} =$	$\frac{1}{2} + 4\frac{5}{16} =$	$4\frac{1}{2} + \frac{3}{10} =$	$\frac{2}{5} + 8\frac{1}{10} =$	$\frac{1}{4} + 5\frac{5}{12} =$

Copy and add:

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
5.	$7\frac{1}{2}$	$8\frac{1}{4}$	$6\frac{1}{2}$	$4\frac{3}{4}$	$16\frac{1}{3}$	$\frac{1}{3}$	$5\frac{1}{5}$	$8\frac{1}{8}$	$4\frac{1}{4}$	$6\frac{2}{3}$
	$\frac{3}{5}$	$\frac{2}{5}$	$\frac{1}{3}$	$\frac{1}{6}$	$\frac{1}{8}$	$6\frac{1}{2}$	$\frac{3}{10}$	$\frac{1}{6}$	$\frac{1}{3}$	$\frac{1}{4}$
6.	$5\frac{3}{4}$	$6\frac{7}{8}$	$5\frac{5}{8}$	$\frac{2}{3}$	$10\frac{3}{4}$	$8\frac{5}{6}$	$5\frac{1}{2}$	$5\frac{3}{4}$	$\frac{7}{8}$	$3\frac{3}{8}$
	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{1}{3}$	$6\frac{7}{8}$	$\frac{5}{6}$	$\frac{1}{4}$	$\frac{5}{9}$	$\frac{1}{3}$	$5\frac{5}{6}$	$\frac{1}{6}$



Subtracting Fractions from Mixed Numbers

1. "The Smith cottage is $7\frac{3}{4}$ miles from here. Drive out this road $\frac{1}{2}$ mile and take the crossroad to the right," said the boy at the fruit stand by the side of the road. How far is it from the crossroad to the cottage?

$$\begin{array}{r} 7\frac{3}{4} = 7\frac{3}{4} \\ \frac{1}{2} = \frac{2}{4} \\ \hline 7\frac{1}{4} \end{array}$$

Tell how these examples were worked:

$$\begin{array}{r} 11\frac{1}{4} = 11\frac{3}{12} \\ \frac{1}{12} = \frac{1}{12} \\ \hline 11\frac{2}{12} = 11\frac{1}{6} \end{array} \qquad \begin{array}{r} 8\frac{5}{6} = 8\frac{5}{6} \\ \frac{1}{3} = \frac{2}{6} \\ \hline 8\frac{3}{6} = 8\frac{1}{2} \end{array}$$

2. A whole piece of cheese weighed $5\frac{7}{8}$ pounds. The grocer cut off a piece that weighed $\frac{3}{4}$ of a pound. For how many pounds should the grocer charge a man who wants to buy what is left?

3. Mrs. Baker is using a cooky recipe which calls for $2\frac{3}{4}$ cups of sugar. She has $\frac{1}{2}$ cup of sugar. How much more sugar does she need for the cookies?

Subtract	*Check*
$4\frac{2}{3} = 4\frac{4}{6}$	$4\frac{3}{6}$
$\frac{1}{6} = \frac{1}{6}$	$\frac{1}{6}$
$4\frac{3}{6} = 4\frac{1}{2}$	$4\frac{4}{6} = 4\frac{2}{3}$

4. Copy, subtract, and check:

(a)	*(b)*	*(c)*	*(d)*	*(e)*
$1\frac{1}{2}$	$6\frac{3}{4}$	$5\frac{3}{4}$	$5\frac{2}{3}$	$3\frac{3}{4}$
$\frac{1}{4}$	$\frac{3}{8}$	$\frac{5}{12}$	$\frac{1}{6}$	$\frac{1}{8}$

Using a Whole in Subtracting

1. Alice needs $3\frac{1}{3}$ yards of ribbon. She has $\frac{2}{3}$ of a yard. How many more yards does she need?

To find "how many more?" we subtract.

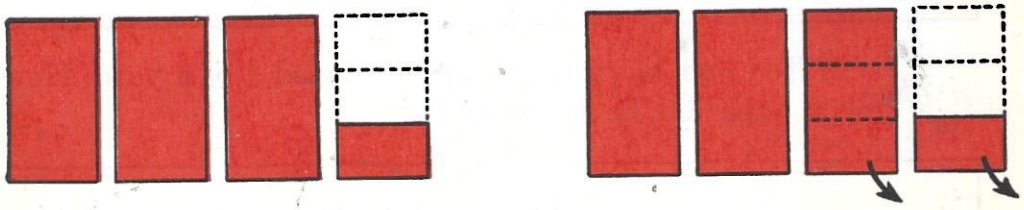
We cannot take $\frac{2}{3}$ from $\frac{1}{3}$. We must use 1 of the 3 wholes that we have. We change the 1 to $\frac{3}{3}$. Then $3\frac{1}{3} = 2\frac{3}{3} + \frac{1}{3} = 2\frac{4}{3}$.

Now we subtract $\frac{2}{3}$ from $2\frac{4}{3}$.

Alice needs $2\frac{2}{3}$ yards of ribbon.

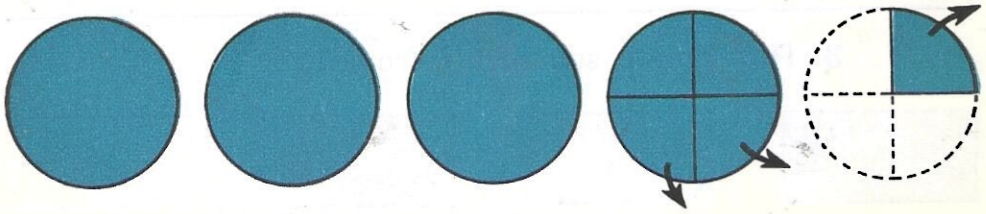
$$\begin{array}{r} 3\frac{1}{3} = 2\frac{4}{3} \\ \underline{\frac{2}{3} = \frac{2}{3}} \\ 2\frac{2}{3} \end{array}$$

Look at the picture below. Do you see that $3\frac{1}{3} - \frac{2}{3} = 2\frac{2}{3}$?



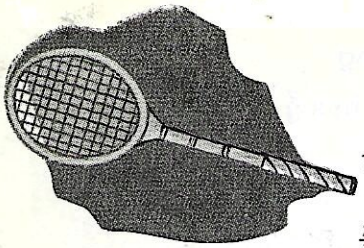
2. Jack spent $1\frac{1}{4}$ hours studying arithmetic and $\frac{3}{4}$ of an hour studying history. How much longer did he study arithmetic than he studied history?

3. Use the picture to answer this question: $4\frac{1}{4} - \frac{3}{4} = ?$



4. Copy and subtract:

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
$6\frac{1}{5}$	$7\frac{3}{8}$	$5\frac{5}{12}$	$8\frac{1}{3}$	$8\frac{1}{6}$	$9\frac{3}{16}$	$10\frac{1}{5}$	$7\frac{7}{10}$	$9\frac{1}{9}$
$\underline{\frac{4}{5}}$	$\underline{\frac{7}{8}}$	$\underline{\frac{7}{12}}$	$\underline{\frac{2}{3}}$	$\underline{\frac{5}{6}}$	$\underline{\frac{5}{16}}$	$\underline{\frac{3}{5}}$	$\underline{\frac{9}{10}}$	$\underline{\frac{4}{9}}$



Using a Whole in Subtracting

Sam and Ted were taping the handles of their badminton rackets.

1. Sam had $1\frac{3}{4}$ yards of tape. He used $\frac{2}{3}$ of a yard. How much tape was left?

$$\begin{array}{r} 1\frac{3}{4} = 1\frac{9}{12} \\ \underline{\frac{2}{3} = \frac{8}{12}} \\ 1\frac{1}{12} \end{array}$$

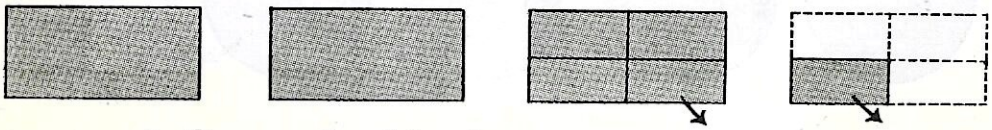
We first change the fourths and thirds to twelfths, or to parts of the same size. Next, we subtract the fractions. Then we subtract the whole numbers.

2. Ted had $1\frac{2}{3}$ yards of tape. He used $\frac{3}{4}$ of a yard. How much tape did he have left?

$$\begin{array}{r} 1\frac{2}{3} = 1\frac{8}{12} = \frac{20}{12} \\ \underline{\frac{3}{4} = \frac{9}{12} = \frac{9}{12}} \\ \frac{11}{12} \end{array}$$

We cannot subtract the twelfths. We cannot take $\frac{9}{12}$ from $\frac{8}{12}$. We use the 1 whole that we have. We change it to $\frac{12}{12}$. So $1\frac{2}{3} = 1\frac{8}{12} = \frac{12}{12} + \frac{8}{12} = \frac{20}{12}$. Now we take $\frac{9}{12}$ from $\frac{20}{12}$.

3. How do we subtract $\frac{1}{2}$ from $3\frac{1}{4}$?



4. Copy and subtract:

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
$4\frac{1}{6}$	$3\frac{5}{6}$	$5\frac{1}{2}$	$6\frac{1}{3}$	$8\frac{1}{8}$	$7\frac{1}{3}$	$9\frac{2}{3}$	$11\frac{1}{2}$	$10\frac{2}{5}$
$\underline{\frac{1}{2}}$	$\underline{\frac{7}{8}}$	$\underline{\frac{5}{6}}$	$\underline{\frac{3}{4}}$	$\underline{\frac{3}{4}}$	$\underline{\frac{1}{5}}$	$\underline{\frac{5}{12}}$	$\underline{\frac{9}{16}}$	$\underline{\frac{1}{2}}$

Adding Mixed Numbers

1. Mrs. West bought 2 chickens. One weighed $4\frac{1}{4}$ pounds, and the other weighed $5\frac{1}{2}$ pounds. How much did both chickens weigh?

$$\begin{array}{r} 4\frac{1}{4} = 4\frac{1}{4} \\ \underline{5\frac{1}{2} = 5\frac{2}{4}} \\ 9\frac{3}{4} \end{array}$$

2. One day Mrs. White gathered $7\frac{3}{4}$ dozen eggs. The next day she gathered $7\frac{5}{12}$ dozen eggs. How many eggs did she gather in all?

$$\begin{array}{r} 7\frac{3}{4} = 7\frac{9}{12} \\ \underline{7\frac{5}{12} = 7\frac{5}{12}} \\ 14\frac{14}{12} = 15\frac{2}{12} = 15\frac{1}{6} \end{array}$$

3. Tell how these mixed numbers were added:

$$\begin{array}{r} 4\frac{1}{4} = 4\frac{1}{4} \\ \underline{2\frac{1}{2} = 2\frac{2}{4}} \\ 6\frac{3}{4} \end{array} \qquad \begin{array}{r} 5\frac{1}{6} = 5\frac{1}{6} \\ \underline{9\frac{1}{2} = 9\frac{3}{6}} \\ 14\frac{4}{6} = 14\frac{2}{3} \end{array} \qquad \begin{array}{r} 7\frac{3}{4} = 7\frac{6}{8} \\ \underline{8\frac{7}{8} = 8\frac{7}{8}} \\ 15\frac{13}{8} = 16\frac{5}{8} \end{array}$$

4. Mary brought $2\frac{1}{2}$ pounds of candy to the school party, and Jane brought $1\frac{3}{4}$ pounds. How many pounds of candy did they both bring?

5. A lady bought two short pieces of silk at a sale. One was $\frac{5}{6}$ yard, and the other was $\frac{1}{2}$ yard. How much silk was in both pieces?

6. One day Jerry played baseball for $2\frac{1}{3}$ hours and went swimming in the pool for $\frac{3}{4}$ of an hour. How much time altogether did he spend on baseball and swimming?

Add:

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
7.	$3\frac{1}{4}$	$3\frac{3}{4}$	$9\frac{9}{16}$	$8\frac{3}{4}$	$6\frac{3}{8}$	$14\frac{1}{8}$	$8\frac{3}{4}$	$7\frac{1}{4}$	$6\frac{1}{2}$
	$\underline{4\frac{1}{2}}$	$\underline{5\frac{3}{8}}$	$\underline{4\frac{1}{2}}$	$\underline{6\frac{7}{8}}$	$\underline{6\frac{1}{2}}$	$\underline{6\frac{1}{4}}$	$\underline{9\frac{1}{2}}$	$\underline{8\frac{3}{8}}$	$\underline{3\frac{7}{8}}$
8.	$7\frac{3}{8}$	$2\frac{1}{4}$	$8\frac{1}{2}$	$6\frac{3}{4}$	$8\frac{3}{4}$	$15\frac{7}{8}$	$8\frac{1}{2}$	$8\frac{7}{8}$	$1\frac{1}{2}$
	$\underline{6\frac{3}{4}}$	$\underline{12\frac{3}{8}}$	$\underline{15\frac{5}{8}}$	$\underline{10\frac{1}{8}}$	$\underline{7\frac{3}{8}}$	$\underline{12\frac{1}{2}}$	$\underline{12\frac{1}{8}}$	$\underline{9\frac{1}{4}}$	$\underline{3\frac{2}{5}}$

Adding Mixed Numbers with Carrying

To add mixed numbers, first we add the fractions. Then we add the whole numbers.

$$\begin{array}{r} 3\frac{1}{2} = 3\frac{3}{6} \\ 4\frac{1}{3} = 4\frac{2}{6} \\ \hline 7\frac{5}{6} \end{array}$$

First, we add the fractions. But before we can add them, we must change them to parts of the same size. $\frac{3}{6} + \frac{2}{6} = \frac{5}{6}$. We write $\frac{5}{6}$ under the fractions.

Then we add the whole numbers and write our answer in its proper place.

$$\begin{array}{r} 3\frac{1}{2} = 3\frac{3}{6} \\ 4\frac{2}{3} = 4\frac{4}{6} \\ \hline 7\frac{7}{6} = 8\frac{1}{6} \end{array}$$

First, we add the fractions: $\frac{3}{6} + \frac{4}{6} = \frac{7}{6} = 1\frac{1}{6}$. We write the $\frac{1}{6}$ and carry the 1 to the whole numbers.

Then we add the whole numbers: 1 (carried) and 3 are 4, and 4 are 8.

1. Mrs. West wants to buy a carpet for the stairs and a runner for the hall. Jim measured the stairs and the hall. Jim said, "We need $10\frac{2}{3}$ yards of carpet for the stairs and $8\frac{2}{3}$ yards for the hall. We need $19\frac{1}{3}$ yards in all." Was Jim right?

2. A rope, $12\frac{1}{2}$ feet long, is fastened to another rope, $16\frac{7}{8}$ feet long. How long are the two pieces of rope?

3. Mrs. Wallace baked $2\frac{1}{2}$ pounds of butter cookies and $3\frac{3}{4}$ pounds of oatmeal cookies. How many pounds of cookies did she bake?

4. Copy and add:

(*a*)	(*b*)	(*c*)	(*d*)	(*e*)	(*f*)	(*g*)	(*h*)	(*i*)	(*j*)
$2\frac{1}{2}$	$4\frac{2}{3}$	$3\frac{2}{5}$	$8\frac{3}{4}$	$7\frac{1}{2}$	$3\frac{7}{12}$	$9\frac{1}{2}$	$5\frac{2}{3}$	$7\frac{2}{3}$	$1\frac{1}{4}$
$4\frac{1}{4}$	$7\frac{1}{2}$	$2\frac{3}{5}$	$5\frac{3}{8}$	$6\frac{5}{8}$	$4\frac{2}{3}$	$10\frac{1}{2}$	$6\frac{3}{4}$	$8\frac{1}{2}$	$3\frac{1}{6}$

5. How do we add these mixed numbers?

$2\frac{3}{4} = 2\frac{9}{12}$ $\quad$ $4\frac{5}{6} = 4\frac{10}{12}$ $\quad$ $4\frac{5}{6} = 4\frac{25}{30}$

$5\frac{1}{6} = 5\frac{2}{12}$ $\quad$ $5\frac{1}{4} = 5\frac{3}{12}$ $\quad$ $4\frac{3}{10} = 4\frac{9}{30}$

$7\frac{11}{12}$ $\quad$ $9\frac{13}{12} = 10\frac{1}{12}$ $\quad$ $8\frac{34}{30} = 9\frac{4}{30} = 9\frac{2}{15}$

6. Jim lives $5\frac{3}{4}$ blocks from school. How far does he walk in going to school in the morning and back home in the afternoon?

7. Jim and Joe picked $13\frac{1}{2}$ bushels of apples in the morning. In the afternoon they stopped when they had picked $9\frac{1}{2}$ bushels. How many bushels of apples did they pick that day?

8. Bob bought $2\frac{3}{4}$ pounds of butter for his mother on Tuesday and $3\frac{1}{2}$ pounds on Saturday. How many pounds of butter did he buy on both days?

9. Jane went with her father on a trip in the car. They drove $158\frac{3}{10}$ miles on Saturday and $224\frac{5}{10}$ miles on Sunday. How many miles did they drive?

10. Mrs. West bought $7\frac{1}{3}$ yards of cloth to cover a chair and $11\frac{1}{4}$ yards to cover a sofa. How much cloth did she buy?

Subtracting Mixed Numbers

$6\frac{3}{4} = 6\frac{3}{4}$
$2\frac{1}{2} = 2\frac{2}{4}$
$4\frac{1}{4}$

1. The water at one end of the swimming pool is $6\frac{3}{4}$ feet deep. At the other end it is only $2\frac{1}{2}$ feet deep. How much deeper is the water at one end than at the other?

$68\frac{1}{2} = 68\frac{2}{4}$
$56\frac{1}{4} = 56\frac{1}{4}$
$12\frac{1}{4}$

2. Tom is $56\frac{1}{4}$ inches tall, and his father is $68\frac{1}{2}$ inches tall. What is the difference in their heights?

3. Tell how these examples were worked:

$11\frac{1}{4} = 11\frac{3}{12}$
$11\frac{1}{12} = 11\frac{1}{12}$
$\frac{2}{12} = \frac{1}{6}$

$18\frac{3}{5} = 18\frac{6}{10}$
$5\frac{1}{10} = 5\frac{1}{10}$
$13\frac{5}{10} = 13\frac{1}{2}$

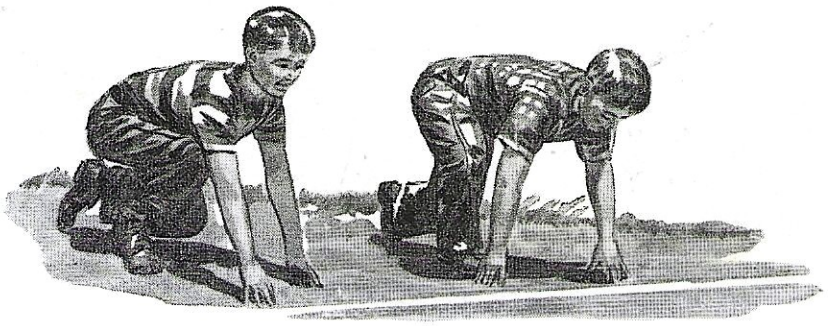
$15\frac{5}{6} = 15\frac{5}{6}$
$8\frac{1}{3} = 8\frac{2}{6}$
$7\frac{3}{6} = 7\frac{1}{2}$

4. In the running broad jump Tom jumped $10\frac{3}{4}$ feet. Joe jumped $9\frac{1}{2}$ feet. How much farther did Tom jump than Joe?

5. Jim ran the 50-yard dash in $8\frac{4}{5}$ seconds, and Bill ran it in $8\frac{2}{5}$ seconds. Which boy ran faster and how much faster?

6. Subtract. If any of your answers are not in lowest terms, change them to lowest terms.

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
$10\frac{3}{5}$	$14\frac{1}{2}$	$15\frac{1}{2}$	$8\frac{5}{6}$	$8\frac{7}{12}$	$9\frac{3}{4}$	$8\frac{5}{6}$	$17\frac{11}{12}$	$9\frac{5}{7}$
$6\frac{2}{5}$	$2\frac{3}{8}$	$6\frac{1}{10}$	$4\frac{1}{6}$	$6\frac{1}{2}$	$5\frac{1}{2}$	$3\frac{1}{2}$	$6\frac{1}{6}$	$1\frac{1}{3}$



Subtracting Mixed Numbers

To subtract mixed numbers, we subtract the parts first. Then we subtract the whole numbers. We carry back a whole and use it with the fraction when we need it.

After we change the fractions to parts of the same size, we notice that we cannot take $\frac{3}{6}$ from $\frac{2}{6}$. We use 1 of the 7 wholes with the $\frac{2}{6}$. $1 = \frac{6}{6}$; so $7\frac{2}{6} = 6\frac{8}{6}$. Now we take $\frac{3}{6}$ from $\frac{8}{6}$, and we take 2 from 6.

The answer is $4\frac{5}{6}$.

$$\begin{array}{r} 7\frac{1}{3} = 7\frac{2}{6} = 6\frac{8}{6} \\ \underline{2\frac{1}{2} = 2\frac{3}{6} = 2\frac{3}{6}} \\ 4\frac{5}{6} \end{array}$$

1. Some of the pupils in the fifth grade wish to find how much each one gained in weight during the past year. Each pupil's weight now and his weight a year ago are shown in the chart below. Find how much each pupil gained in weight.

Name	Weight One Year Ago	Weight Now	Gain in Pounds
Betty W.	$99\frac{3}{4}$	114	
Anna G.	$65\frac{1}{16}$	$72\frac{1}{4}$	
William B.	$86\frac{3}{4}$	$90\frac{1}{2}$	
Raymond A.	$54\frac{3}{4}$	$61\frac{7}{16}$	

2. Copy and subtract:

(a)	(b)	(c)	(d)	(e)	(f)
$12\frac{1}{2}$	$7\frac{1}{6}$	$8\frac{3}{4}$	$15\frac{1}{3}$	$10\frac{1}{4}$	12
$\underline{5\frac{2}{3}}$	$\underline{4\frac{1}{3}}$	$\underline{6\frac{7}{8}}$	$\underline{8\frac{1}{2}}$	$\underline{6\frac{1}{3}}$	$\underline{6\frac{7}{8}}$

Adding Three Mixed Numbers

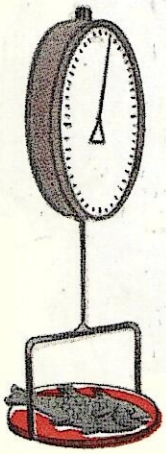
Study these examples. Tell how they were added:

$$\begin{array}{r} 5\frac{1}{2} = 5\frac{3}{6} \\ 3\frac{2}{3} = 3\frac{4}{6} \\ \underline{4\frac{1}{6} = 4\frac{1}{6}} \\ 12\frac{8}{6} = 13\frac{2}{6} = 13\frac{1}{3} \end{array} \qquad \begin{array}{r} 6\frac{1}{2} = 6\frac{6}{12} \\ 8\frac{1}{3} = 8\frac{4}{12} \\ \underline{4\frac{1}{4} = 4\frac{3}{12}} \\ 18\frac{13}{12} = 19\frac{1}{12} \end{array} \qquad \begin{array}{r} 7\frac{1}{2} = 7\frac{12}{24} \\ 4\frac{1}{3} = 4\frac{8}{24} \\ \underline{3\frac{1}{8} = 3\frac{3}{24}} \\ 14\frac{23}{24} \end{array}$$

Copy and add:

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
1.	$8\frac{1}{3}$	$4\frac{1}{8}$	$6\frac{1}{4}$	$5\frac{1}{3}$	$5\frac{1}{4}$	$1\frac{1}{4}$	$6\frac{1}{3}$	$8\frac{1}{2}$	$3\frac{1}{6}$
	$2\frac{5}{6}$	$2\frac{5}{8}$	$2\frac{1}{2}$	$2\frac{1}{6}$	$\frac{1}{3}$	$3\frac{5}{6}$	$5\frac{5}{12}$	$11\frac{1}{3}$	$4\frac{1}{8}$
	$7\frac{5}{6}$	$6\frac{7}{8}$	8	$5\frac{1}{2}$	$2\frac{1}{6}$	$6\frac{2}{3}$	$7\frac{1}{6}$	$20\frac{3}{4}$	$5\frac{1}{3}$
2.	$5\frac{1}{3}$	$4\frac{7}{16}$	$5\frac{1}{3}$	$3\frac{7}{12}$	$4\frac{1}{5}$	$1\frac{5}{6}$	$8\frac{1}{4}$	$2\frac{2}{9}$	$8\frac{1}{3}$
	$2\frac{1}{4}$	$3\frac{5}{8}$	$2\frac{3}{4}$	$4\frac{1}{3}$	$6\frac{1}{2}$	$7\frac{3}{4}$	$9\frac{3}{4}$	$3\frac{1}{3}$	$1\frac{2}{5}$
	$4\frac{1}{6}$	$2\frac{1}{4}$	$6\frac{5}{6}$	$3\frac{3}{4}$	$5\frac{7}{10}$	$3\frac{5}{12}$	$4\frac{3}{4}$	$12\frac{1}{9}$	$3\frac{1}{3}$

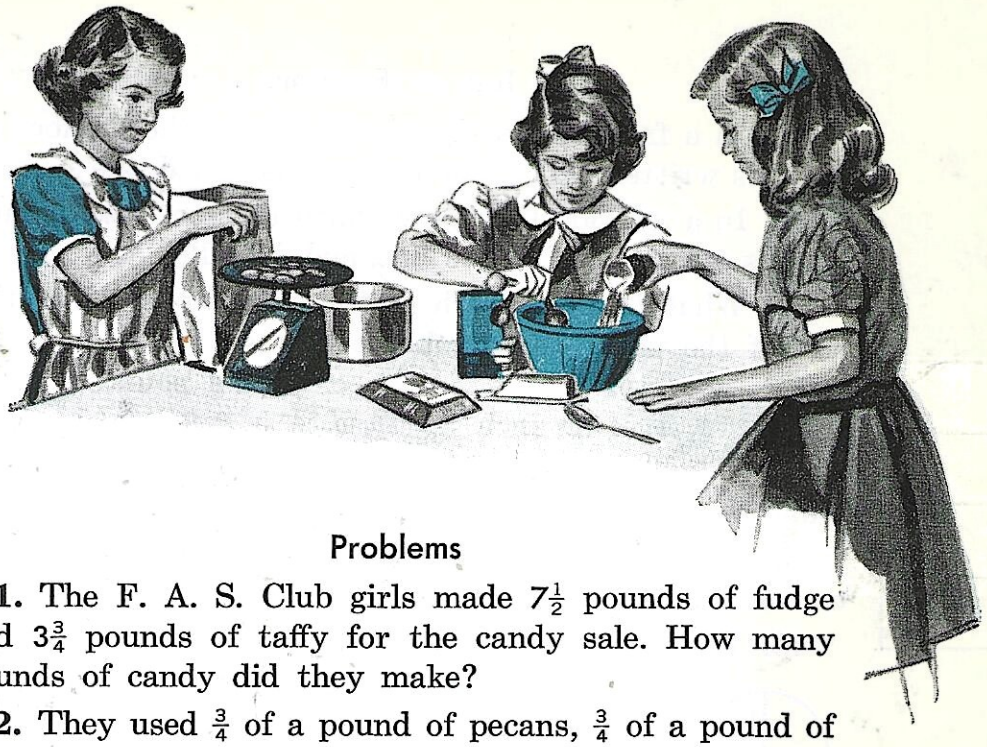
3. Jack caught a fish that weighed 2 pounds. Jim caught a fish that weighed $2\frac{1}{2}$ pounds. Joe caught a fish that weighed $1\frac{3}{4}$ pounds. How much do the 3 fish weigh?



4. Our troop of Boy Scouts took a long hike. We walked $3\frac{1}{2}$ miles the first hour, $3\frac{3}{8}$ miles the second hour, and $2\frac{3}{4}$ miles the third hour. How far did we walk in the three hours?

5. Mrs. Walters measured $3\frac{1}{4}$ pounds of brown sugar, $2\frac{3}{4}$ pounds of white sugar, and $\frac{5}{8}$ pound of powdered sugar. How many pounds of sugar was that?

6. Tom worked after school for these periods of time: $2\frac{1}{2}$ hours, $3\frac{2}{3}$ hours, and $6\frac{1}{4}$ hours. How long did he work altogether?



Problems

1. The F. A. S. Club girls made $7\frac{1}{2}$ pounds of fudge and $3\frac{3}{4}$ pounds of taffy for the candy sale. How many pounds of candy did they make?

2. They used $\frac{3}{4}$ of a pound of pecans, $\frac{3}{4}$ of a pound of walnuts, and $\frac{1}{2}$ of a pound of hickory nuts. Did they use more or less than 1 pound of nuts? How much more than a pound did they use?

3. They need $8\frac{2}{3}$ yards of curtain material for one window of their club room. For another window they need $8\frac{2}{3}$ yards of curtain material, and for the third window they need $9\frac{1}{4}$ yards. If they buy 28 yards of curtain material, will they have enough for the 3 windows?

Find the answers:

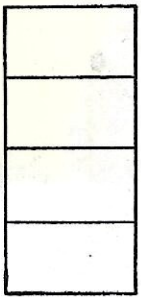
	(*a*)	(*b*)	(*c*)	(*d*)	(*e*)
4.	$3\frac{3}{4} + 6\frac{1}{8}$	$5\frac{7}{8} - 3\frac{1}{8}$	$12 - 8\frac{1}{3}$	$4 + 6\frac{2}{3}$	$5\frac{1}{5} - 1\frac{2}{3}$
5.	$8\frac{2}{5} - 5\frac{3}{5}$	$5\frac{1}{6} + 8\frac{1}{4}$	$7\frac{1}{4} - 6\frac{1}{2}$	$5\frac{2}{3} + 4\frac{1}{4}$	$6\frac{1}{7} - 2\frac{1}{2}$
6.	$8\frac{1}{2} - 6\frac{3}{4}$	$4\frac{7}{8} + 5\frac{1}{2}$	$10 - 5\frac{2}{3}$	$8\frac{3}{8} - 5\frac{7}{16}$	$7\frac{3}{4} - 5\frac{1}{3}$

A Test on Fractions

1. In a fraction the figure which tells the number of parts is written _____ the line and is called the _____.

2. In a fraction the figure which tells the size of each part is written _____ the line and is called the _____.

3. What figure in each of these fractions shows the size of the part? the number of parts?



a. $\frac{5}{8}$ of a cake

b. $\frac{3}{4}$ of an inch

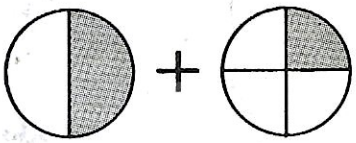
c. $\frac{1}{2}$ of a pound

d. $\frac{1}{8}$ of a circle

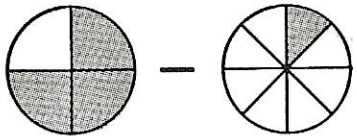
4. Before we can add or subtract parts, the parts must be the _____ size.

5. Is the piece of paper divided into halves, thirds, or fourths?

6. What addition does Picture A show?



Picture A



Picture B

7. What subtraction does Picture B show?

8. When we add mixed numbers, we add the _____ first. Then we add the _____ numbers. When the sum of the fractions is 1 or more, we write the fraction and _____ the whole number.

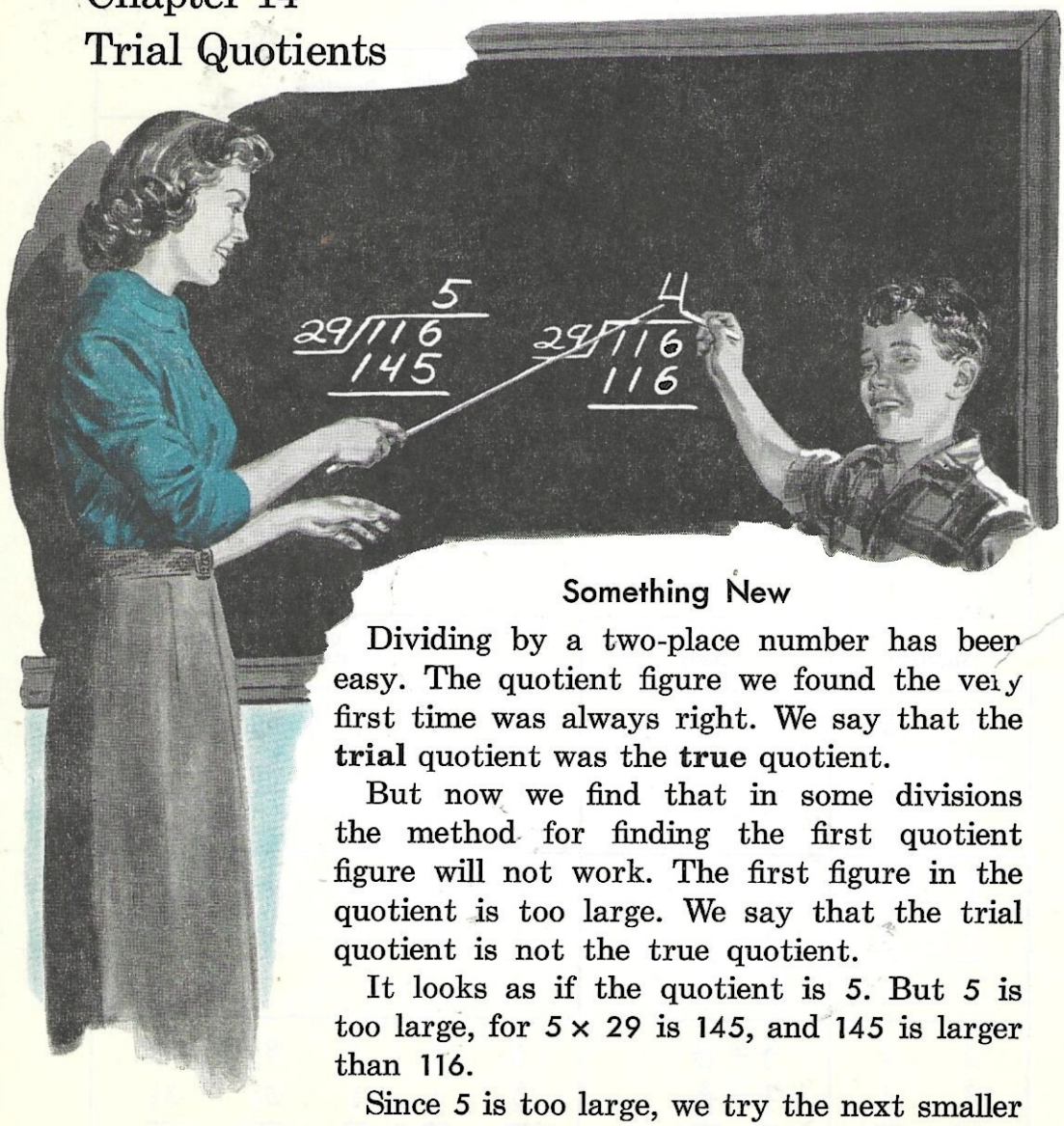
9. Terry weighs $87\frac{1}{2}$ pounds with his overcoat off and $94\frac{1}{2}$ pounds with his overcoat on. His overcoat weighs _____ pounds.

10. Sue weighed $79\frac{3}{4}$ pounds at the beginning of her vacation and $83\frac{1}{2}$ pounds when her vacation was over. She gained _____ pounds during her vacation.

Test: Adding and Subtracting Fractions

Add	*Study*	*Practice*
$\frac{2}{5}$ $\frac{2}{3}$ $\frac{1}{5}$ $\frac{1}{3}$	$\frac{2}{9}$ $\frac{1}{4}$ $\frac{2}{9}$ $\frac{3}{4}$ $\frac{4}{9}$ $\frac{4}{4} = 1$	$\frac{1}{3}$ $\frac{5}{6}$ $\frac{1}{8}$ $2\frac{1}{2}$ $4\frac{1}{8}$ $\frac{1}{3}$ $\frac{1}{6}$ $\frac{3}{8}$ $5\frac{1}{2}$ $6\frac{3}{8}$
$\frac{1}{4}$ $\frac{1}{3}$ $\frac{1}{2}$ $\frac{1}{6}$	$\frac{1}{2} = \frac{4}{8}$ $\frac{7}{8} = \frac{7}{8}$ $\frac{11}{8} = 1\frac{3}{8}$	$\frac{2}{3}$ $\frac{3}{4}$ $\frac{1}{2}$ $5\frac{1}{4}$ $5\frac{2}{3}$ $\frac{1}{6}$ $\frac{1}{8}$ $\frac{7}{8}$ $3\frac{7}{8}$ $3\frac{5}{6}$
$\frac{1}{4}$ $\frac{1}{2}$ $\frac{1}{3}$ $\frac{1}{3}$	$\frac{1}{4} = \frac{3}{12}$ $\frac{2}{3} = \frac{8}{12}$ $\frac{11}{12}$	$\frac{1}{2}$ $\frac{2}{3}$ $\frac{3}{4}$ $6\frac{1}{4}$ $1\frac{1}{6}$ $\frac{1}{5}$ $\frac{3}{8}$ $\frac{2}{3}$ $4\frac{2}{3}$ $4\frac{1}{4}$
Subtract	*Study*	*Practice*
$\frac{5}{6}$ $\frac{5}{9}$ $\frac{1}{6}$ $\frac{4}{9}$	$\frac{7}{8}$ $\frac{1}{8}$ $\frac{6}{8} = \frac{3}{4}$	$\frac{3}{4}$ $\frac{7}{8}$ $\frac{7}{12}$ $6\frac{3}{8}$ $7\frac{5}{16}$ $\frac{1}{4}$ $\frac{3}{8}$ $\frac{5}{12}$ $4\frac{1}{8}$ $2\frac{1}{16}$
$\frac{7}{8}$ $\frac{3}{4}$ $\frac{1}{4}$ $\frac{1}{2}$	$\frac{7}{8} = \frac{7}{8}$ $\frac{1}{2} = \frac{4}{8}$ $\frac{3}{8}$	$\frac{5}{6}$ $\frac{5}{8}$ $\frac{2}{3}$ $9\frac{7}{16}$ $3\frac{7}{10}$ $\frac{1}{2}$ $\frac{1}{4}$ $\frac{7}{12}$ $1\frac{1}{8}$ $1\frac{1}{2}$
$\frac{3}{4}$ $\frac{3}{4}$ $\frac{2}{3}$ $\frac{1}{6}$	$\frac{2}{3} = \frac{8}{12}$ $\frac{1}{4} = \frac{3}{12}$ $\frac{5}{12}$	$\frac{2}{3}$ $\frac{1}{2}$ $\frac{2}{3}$ $8\frac{2}{3}$ $4\frac{7}{8}$ $\frac{1}{4}$ $\frac{1}{3}$ $\frac{5}{8}$ $5\frac{1}{2}$ $3\frac{1}{3}$

Chapter 14
Trial Quotients



Something New

Dividing by a two-place number has been easy. The quotient figure we found the very first time was always right. We say that the **trial** quotient was the **true** quotient.

But now we find that in some divisions the method for finding the first quotient figure will not work. The first figure in the quotient is too large. We say that the trial quotient is not the true quotient.

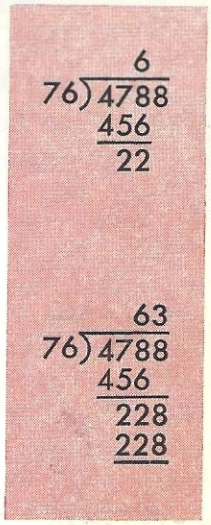
It looks as if the quotient is 5. But 5 is too large, for 5×29 is 145, and 145 is larger than 116.

Since 5 is too large, we try the next smaller number, 4. The quotient 4 is correct, for 4×29 is 116.

True Quotient Answers

In this example we wish to find how many 76's are in 4788. To divide, we think of the 7 (tens) as 7, and think, "Sevens in 47, 6." We write 6 in its proper place and multiply. We notice the product, 456, and see that it is less than 478; so we subtract. We now notice the remainder, 22, and see that it is less than the divisor, 76. So we bring down the next figure.

Again we think of the 7 (tens) as 7, and think, "Sevens in 22, 3." We write 3 in the answer and multiply. We notice the product, 228, and see that it is the same as the 228 above it. There is no remainder and there is nothing to bring down; so we have finished the example.



At the beginning of the example when we think, "Sevens in 47, 6," we write 6 and **try it** to see if it is correct. We multiply and notice that the product is less than the number above it. We are now almost sure, but not quite, that 6 is the true quotient answer. We subtract and notice that the remainder is less than the divisor. We are now sure that 6 is the true quotient answer. We bring down the next figure and try for an answer here.

We think, "Sevens in 22, 3," and we try 3 as a quotient answer. We multiply and notice that the product is the same as the number above it. This makes us sure that the trial answer is also the true answer.

Remember: The product, if it is not the same as the number above it, must be less. The remainder, if there is one, must be less than the divisor.

Trial Quotient Answers

When we divide by tens and ones, it often happens that the trial quotient answer does not turn out to be the true quotient answer. When this happens, we have to keep on trying other answers until we find the true answer.

```
   7
76)4940
   532
```

In this example we wish to find how many 76's there are in 4940. To divide, we think of the 7 (tens) as 7, and think, "Sevens in 49, 7." We write 7 in its proper place and multiply. After we multiply, we notice that the product, 532, is greater than the number, 494, above it. This makes us certain that our **trial** answer is not the **true** answer. Our trial quotient is too large. So we erase and try the next smaller number, 6, as a quotient answer.

```
   6
76)4940
   456
   38
```

We try 6 by multiplying, and we notice that the product, 456, is less than the number, 494, above it. We are almost sure that 6 is the true quotient answer, but not quite. We subtract and notice that the remainder, 38, is less than the divisor, 76. We are now sure that 6 is the true quotient answer; so we bring down the next number.

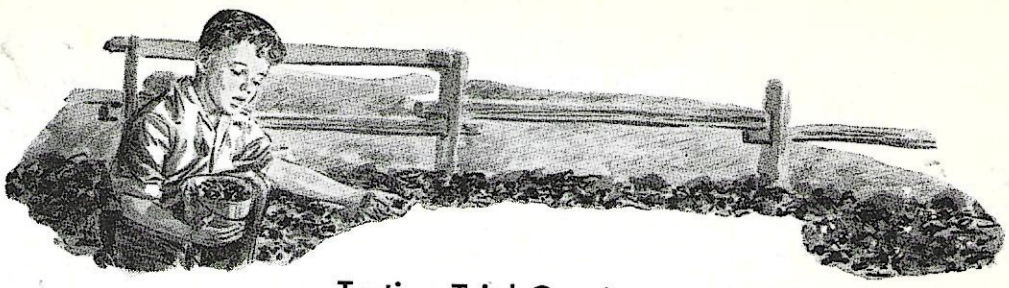
```
   65
76)4940
   456
   380
   380
```

Again we think of 7 (tens) as 7, and think, "Sevens in 38, 5." We try 5 by multiplying, and we notice that the product, 380, is the same as the number, 380, above it. This makes us sure that 5 is the true quotient.

Check

```
  76
  65
 380
456
4940
```

If we wish, we can check our answer by multiplying 76 by 65.



Testing Trial Quotients

1. Last summer Billy visited his grandfather on the farm. He helped pick the strawberries. His grandfather said, "We have now picked 168 quarts. A crate holds 24 quarts. Will you get the crates ready?"

How many crates should Billy get ready?

Trial Quotient

$$24\overline{)168}\quad 8$$

Too Large

$$\begin{array}{r} 8 \\ 24\overline{)168} \\ \underline{192} \end{array}$$

True Quotient

$$\begin{array}{r} 7 \\ 24\overline{)168} \\ \underline{168} \end{array}$$

2. "You certainly sell a lot of berries," said Billy.

"Yes," answered his grandfather. "Last year we sold 1728 quarts. How many crates was that?"

Trial Quotient

$$24\overline{)1728}\quad 8$$

Too Large

$$\begin{array}{r} 8 \\ 24\overline{)1728} \\ \underline{192} \end{array}$$

Not Too Large

$$\begin{array}{r} 7 \\ 24\overline{)1728} \\ \underline{168} \end{array}$$

True Quotient

$$\begin{array}{r} 7 \\ 24\overline{)1728} \\ \underline{168} \\ 4 \end{array}$$

3. "So far this year we have sold 1248 quarts," continued his grandfather. "That's over 50 crates."

How many crates will 1248 quart boxes fill?

Trial Quotient

$$24\overline{)1248}\quad 6$$

Too Large

$$\begin{array}{r} 6 \\ 24\overline{)1248} \\ \underline{144} \end{array}$$

Not Too Large

$$\begin{array}{r} 5 \\ 24\overline{)1248} \\ \underline{120} \end{array}$$

True Quotient

$$\begin{array}{r} 5 \\ 24\overline{)1248} \\ \underline{120} \\ 4 \end{array}$$

Trial Quotient Answers

Are the trial answers the true answers?

1.

$$12\overline{)516}\quad \begin{array}{r} 5 \\ 60 \end{array} \rightarrow \text{too large}$$

No. Why?

2.

$$12\overline{)372}\quad \begin{array}{r} 3 \\ 36 \\ 1 \end{array} \begin{array}{l} \\ \rightarrow \text{not too large} \\ \rightarrow \text{not too large} \end{array}$$

Yes. Why?

3.

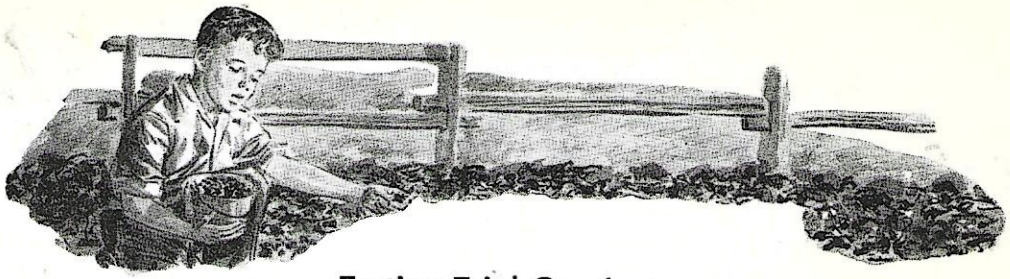
$$75\overline{)6525}\quad \begin{array}{r} 9 \\ 675 \rightarrow \end{array} \times$$

$$75\overline{)6525}\quad \begin{array}{r} 8 \\ 600 \rightarrow \\ 52 \rightarrow \end{array} \checkmark \checkmark$$

Check these **trial** answers to tell which ones are **true**:

	(a)	(b)	(c)	(d)	(e)
4.	$54\overline{)2106}$	$45\overline{)2565}$	$24\overline{)1512}$	$23\overline{)1725}$	$97\overline{)4733}$
5.	$37\overline{)2331}$	$34\overline{)1768}$	$43\overline{)1978}$	$46\overline{)1058}$	$36\overline{)2586}$
6.	$43\overline{)2494}$	$44\overline{)1496}$	$51\overline{)1887}$	$57\overline{)2565}$	$55\overline{)2420}$
7.	$62\overline{)1488}$	$68\overline{)5644}$	$71\overline{)3266}$	$75\overline{)5025}$	$39\overline{)2613}$
8.	$72\overline{)2592}$	$74\overline{)5772}$	$92\overline{)3956}$	$91\overline{)2366}$	$97\overline{)4462}$
9.	$81\overline{)2187}$	$87\overline{)5829}$	$41\overline{)3157}$	$55\overline{)2530}$	$49\overline{)2891}$
10.	$43\overline{)3569}$	$53\overline{)3551}$	$63\overline{)4284}$	$68\overline{)3740}$	$83\overline{)6557}$
11.	$69\overline{)5074}$	$74\overline{)3034}$	$87\overline{)5394}$	$62\overline{)5828}$	$25\overline{)1125}$

Copy each example above and complete the division.



Testing Trial Quotients

1. Last summer Billy visited his grandfather on the farm. He helped pick the strawberries. His grandfather said, "We have now picked 168 quarts. A crate holds 24 quarts. Will you get the crates ready?"

How many crates should Billy get ready?

Trial Quotient	*Too Large*	*True Quotient*
$24\overline{)168}$	$24\overline{)168}$	$24\overline{)168}$
8	8	7
	192 ☜	168 ☜

2. "You certainly sell a lot of berries," said Billy.

"Yes," answered his grandfather. "Last year we sold 1728 quarts. How many crates was that?"

Trial Quotient	*Too Large*	*Not Too Large*	*True Quotient*
$24\overline{)1728}$	$24\overline{)1728}$	$24\overline{)1728}$	$24\overline{)1728}$
8	8	7	7
	192 ☜	168 ☜	168
			4 ☜

3. "So far this year we have sold 1248 quarts," continued his grandfather. "That's over 50 crates."

How many crates will 1248 quart boxes fill?

Trial Quotient	*Too Large*	*Not Too Large*	*True Quotient*
$24\overline{)1248}$	$24\overline{)1248}$	$24\overline{)1248}$	$24\overline{)1248}$
6	6	5	5
	144 ☜	120 ☜	120
			4 ☜

Trial Quotient Answers

Are the trial answers the true answers?

1.
$$12\overline{)516}\quad 5$$
$$\underline{60} \rightarrow \textit{too large}$$

No. Why?

2.
$$12\overline{)372}\quad 3$$
$$\underline{36} \rightarrow \textit{not too large}$$
$$1 \rightarrow \textit{not too large}$$

Yes. Why?

3.
$$75\overline{)6525}\quad 9$$
$$\underline{675} \rightarrow \times$$

$$75\overline{)6525}\quad 8$$
$$\underline{600} \rightarrow \checkmark$$
$$52 \rightarrow \checkmark$$

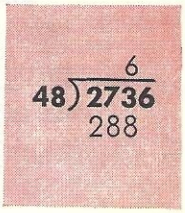
Check these **trial** answers to tell which ones are **true**:

	(a)	(b)	(c)	(d)	(e)
4.	$54\overline{)2106}\ 4$	$45\overline{)2565}\ 6$	$24\overline{)1512}\ 7$	$23\overline{)1725}\ 8$	$97\overline{)4733}\ 5$
5.	$37\overline{)2331}\ 7$	$34\overline{)1768}\ 5$	$43\overline{)1978}\ 4$	$46\overline{)1058}\ 2$	$36\overline{)2586}\ 8$
6.	$43\overline{)2494}\ 6$	$44\overline{)1496}\ 3$	$51\overline{)1887}\ 3$	$57\overline{)2565}\ 5$	$55\overline{)2420}\ 4$
7.	$62\overline{)1488}\ 2$	$68\overline{)5644}\ 9$	$71\overline{)3266}\ 4$	$75\overline{)5025}\ 7$	$39\overline{)2613}\ 8$
8.	$72\overline{)2592}\ 3$	$74\overline{)5772}\ 8$	$92\overline{)3956}\ 4$	$91\overline{)2366}\ 2$	$97\overline{)4462}\ 4$
9.	$81\overline{)2187}\ 2$	$87\overline{)5829}\ 7$	$41\overline{)3157}\ 7$	$55\overline{)2530}\ 5$	$49\overline{)2891}\ 7$
10.	$43\overline{)3569}\ 8$	$53\overline{)3551}\ 7$	$63\overline{)4284}\ 7$	$68\overline{)3740}\ 6$	$83\overline{)6557}\ 8$
11.	$69\overline{)5074}\ 8$	$74\overline{)3034}\ 4$	$87\overline{)5394}\ 6$	$62\overline{)5828}\ 9$	$25\overline{)1125}\ 5$

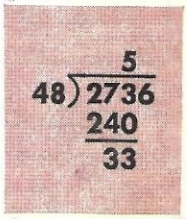
Copy each example above and complete the division.

Trial Quotient Answers

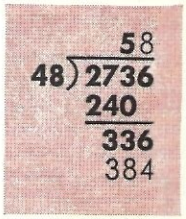
Let us try another example. Suppose we wish to find how many 48's there are in 2736, or to find $\frac{1}{48}$ of 2736.



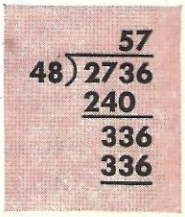
We think of the 4 (tens) as 4, and think, "Fours in 27, 6." We try 6 as a quotient answer by multiplying, and we notice that the product, 288, is greater than the number above it. This makes us certain that 6 is not the true answer. We erase and try the next smaller number, 5, as a quotient answer.



We try 5 by multiplying, and we notice that the product is less than the number above it. But we cannot be entirely sure of 5 until we subtract and notice that the remainder is less than the divisor. When we do that, we are sure that 5 is the true quotient answer. We bring down the next figure.



We think of the 4 (tens) as 4, and think, "Fours in 33, 8." We try 8 by multiplying, and we see that the product is greater than the number above it. This makes us certain that 8 is not the true answer. We erase and try the next smaller number, 7, as a quotient answer.

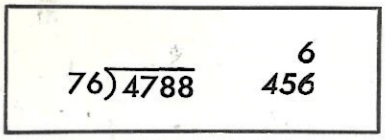


We try 7 by multiplying, and we see that the product is the same as the number above it. This makes us sure that 7 is the true quotient answer.

There is no remainder, and there is nothing to bring down; so our example is finished. We can check our answer by multiplying 48 by 57.

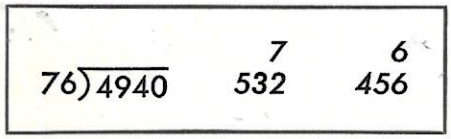
Mental Trials

In the exercises that we have been working, we have been making our trials by actually working them out on paper. This causes us a lot of extra work in writing and in erasing. Let us see how such trials can be made mentally and without so much pencil work and erasing.



We think of the 7 (tens) as 7, and think, "Sevens in 47, 6." Before writing 6, suppose we multiply in our heads: Six 6's are 36. Six 7's are 42, and 3 carried are 45. Our last product, 45, is less than 47; so we can be reasonably sure that 6 is the true quotient. If we cannot multiply mentally, we can write the trial answer and the product at the side of the example or on a separate piece of paper.

We can now write 6 in its proper place, multiply, notice the product, subtract, notice the remainder, and bring down the next figure.



In this example we think of the 7 (tens) as 7, and think, "Sevens in 49, 7." At the side of our example, on a piece of paper, or in our heads, we find the trial quotient and the product. Since 532 is more than 494, we know that our trial quotient is too large. We try the next smaller number, 6. Since 456 is less than 494, we write 6 in the answer, multiply, notice the product, subtract, and notice the remainder. Now we are sure that 6 is the true quotient. So we bring down the next figure.

This is how an example might look with the trial work at the side.

$$\begin{array}{r} 57 \\ 48\overline{)2736} \\ 240 \\ \hline 336 \\ 336 \\ \hline \end{array}$$

6	5
288	240
8	7
384	336

This is how the same example might look when the trial work is done on another piece of paper or in our heads.

$$\begin{array}{r} 57 \\ 48\overline{)2736} \\ 240 \\ \hline 336 \\ 336 \\ \hline \end{array}$$

The trial answer is not the true answer. Here is the way we find the true answer:

Trial 1	Trial 2	Trial 1	Trial 2
$\begin{array}{r} 3 \\ 16\overline{)368} \\ 48 \end{array}$	$\begin{array}{r} 2 \\ 16\overline{)368} \\ 32 \\ \hline 4 \end{array}$	$\begin{array}{r} 24 \\ 16\overline{)368} \\ 32 \\ \hline 48 \\ 64 \end{array}$	$\begin{array}{r} 23 \\ 16\overline{)368} \\ 32 \\ \hline 48 \\ 48 \end{array}$

The true answers are given. Complete the division.

1. $\begin{array}{r} 32 \\ 15\overline{)480} \\ 45 \\ \hline 30 \end{array}$

2. $\begin{array}{r} 57 \\ 24\overline{)1368} \\ 120 \\ \hline 168 \end{array}$

3. $\begin{array}{r} 36 \\ 24\overline{)864} \\ 72 \\ \hline 144 \end{array}$

4. $\begin{array}{r} 18 \\ 34\overline{)612} \\ 34 \\ \hline 272 \end{array}$

5. $\begin{array}{r} 18 \\ 45\overline{)810} \\ 45 \end{array}$

6. $\begin{array}{r} 24 \\ 13\overline{)312} \\ 26 \end{array}$

7. $\begin{array}{r} 36 \\ 36\overline{)1296} \\ 108 \end{array}$

8. $\begin{array}{r} 34 \\ 25\overline{)850} \\ 75 \end{array}$

9. $\begin{array}{r} 28 \\ 58\overline{)1624} \end{array}$

10. $\begin{array}{r} 28 \\ 46\overline{)1288} \end{array}$

11. $\begin{array}{r} 14 \\ 29\overline{)406} \end{array}$

12. $\begin{array}{r} 25 \\ 48\overline{)1200} \end{array}$

13. $\begin{array}{r} 34 \\ 14\overline{)476} \end{array}$

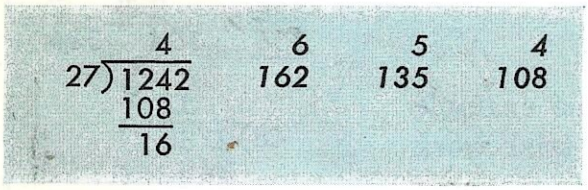
14. $\begin{array}{r} 23 \\ 15\overline{)345} \end{array}$

15. $\begin{array}{r} 34 \\ 13\overline{)442} \end{array}$

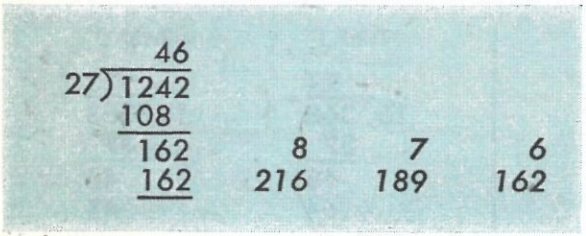
16. $\begin{array}{r} 48 \\ 26\overline{)1248} \end{array}$

Other Trial Quotient Answers

Sometimes we have to try more than one trial quotient before we can find the true one.



We think of the 2 (tens) as 2, and think, "Twos in 12, 6." We try 6 by multiplying, and we notice the product. Next we try 5 in the same way. But 5 is too large. So we try 4. We write 4 in the answer, multiply, notice the product, subtract, notice the remainder, and bring down the next figure.



We think of the 2 (tens) as 2, and think, "Twos in 16, 8." We try 8 by multiplying, and we notice the product. Next we try 7. Then we try 6 in the same way. We write 6 in the answer, multiply, and notice the product.

In dividing by a two-place number, we think of the tens as ones and divide. We try the trial quotient by multiplying. If the product is larger than the number above it, we try the next smaller number as a quotient. We keep on trying the next smaller number until we get the true quotient answer. A quotient answer is the true one: (1) If, when we multiply the divisor by the trial quotient, the product is less than or the same as the number above it in the dividend; and (2) if, when we subtract, the remainder is less than the divisor.

Other Trial Quotient Answers

Notice, first, there are no 28's in 24. Then the question is "How many 28's in 243." Think of the 2 (tens) as 2, and think: "Twos in twenty-four." Of course, the answer is 12. Since 9 is the largest quotient answer we can use at any one time, **do not try 12, then 11, then** 10. Use 9 as the first trial answer. In this case 9 is not the true answer, but 8 is.

$$28\overline{)2436} \qquad \begin{array}{r} 9 \\ 252 \end{array}$$

Notice here there are no 17's in 15. Then the question is "How many 17's in 158." Think of the 1 (ten) as 1, and think, "Ones in fifteen." Since that answer is larger than 9, use 9 as the first trial answer. In this case, 9 proves to be the true answer.

$$17\overline{)1581} \qquad \begin{array}{r} 9 \\ 153 \end{array}$$

Never use a number larger than 9 as the first trial quotient answer.

1. A store has 58 employees. The weekly payroll is $5220. What is the average weekly salary?

2. A farmer planted 864 young apple trees in his orchard. He put 24 trees in each row. How many rows of apple trees did he plant?

Divide and check. **Remember: A trial quotient cannot be larger than 9.**

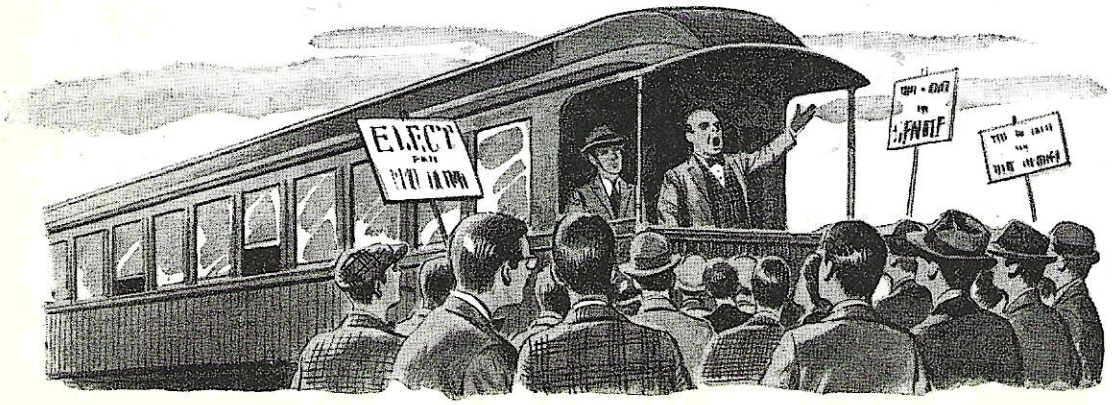
	(*a*)	(*b*)	(*c*)	(*d*)	(*e*)	(*f*)
3.	$15\overline{)135}$	$14\overline{)112}$	$13\overline{)117}$	$12\overline{)108}$	$15\overline{)105}$	$18\overline{)162}$
4.	$16\overline{)128}$	$19\overline{)114}$	$17\overline{)102}$	$18\overline{)144}$	$16\overline{)144}$	$18\overline{)126}$
5.	$19\overline{)171}$	$17\overline{)119}$	$16\overline{)112}$	$17\overline{)136}$	$24\overline{)216}$	$28\overline{)224}$

Exercises

Tell the number we should use as the first trial answer in each of the following examples. Tell why. Find the first true answer in the first example in each row.

	(a)	(b)	(c)	(d)	(e)
1.	$15\overline{)1455}$	$28\overline{)2604}$	$36\overline{)3096}$	$47\overline{)4183}$	$18\overline{)1728}$
2.	$25\overline{)2175}$	$36\overline{)3456}$	$47\overline{)4606}$	$17\overline{)1581}$	$29\overline{)2262}$
3.	$37\overline{)3219}$	$48\overline{)4707}$	$16\overline{)1264}$	$27\overline{)2538}$	$37\overline{)3626}$
4.	$48\overline{)4224}$	$13\overline{)1027}$	$26\overline{)2548}$	$38\overline{)3002}$	$49\overline{)4459}$
5.	$17\overline{)1343}$	$24\overline{)2352}$	$38\overline{)3344}$	$49\overline{)4263}$	$14\overline{)1196}$
6.	$23\overline{)2208}$	$38\overline{)3686}$	$52\overline{)5096}$	$19\overline{)1653}$	$27\overline{)2403}$
7.	$42\overline{)4085}$	$53\overline{)5247}$	$18\overline{)1404}$	$26\overline{)2548}$	$44\overline{)4224}$
8.	$56\overline{)5544}$	$17\overline{)1275}$	$33\overline{)3069}$	$45\overline{)4005}$	$57\overline{)5073}$
9.	$16\overline{)1200}$	$35\overline{)3255}$	$46\overline{)4462}$	$58\overline{)5104}$	$58\overline{)5626}$
10.	$72\overline{)7056}$	$85\overline{)8075}$	$59\overline{)5664}$	$73\overline{)7081}$	$86\overline{)8084}$

11. During an election campaign, a senator traveled 7328 miles in 32 days. How many miles did he average each day?



A Test

Copy the exercises in columns on your paper. Check (√) the trial quotient answers that are also the true quotient answers. Cross (×) the trial quotient answers that are not the true ones.

$32\overline{)2048}$ 6√ $\quad 44\overline{)2948}$ 7× $\quad 53\overline{)2862}$ 4× $\quad 67\overline{)4757}$ 7√

Find out which ones to check (√) and which ones to cross (×) in this way:

$32\overline{)2048}$ 6, 192√, 12√ $\quad 44\overline{)2948}$ 7, 308× $\quad 53\overline{)2862}$ 4, 212√, 74× $\quad 67\overline{)4757}$ 7, 469√, 6√

You do not need to finish working the examples.

	(a)	(b)	(c)	(d)	(e)
1.	$14\overline{)294}$ 2	$16\overline{)384}$ 3	$13\overline{)299}$ 2	$22\overline{)1584}$ 7	$27\overline{)2349}$ 9
2.	$24\overline{)984}$ 4	$25\overline{)1375}$ 6	$32\overline{)2592}$ 8	$33\overline{)2376}$ 7	$19\overline{)1444}$ 9
3.	$46\overline{)2392}$ 5	$46\overline{)3542}$ 8	$44\overline{)3564}$ 8	$57\overline{)2223}$ 4	$38\overline{)1862}$ 6
4.	$53\overline{)2226}$ 4	$56\overline{)2408}$ 4	$69\overline{)4692}$ 7	$64\overline{)4672}$ 7	$49\overline{)4320}$ 9
5.	$63\overline{)4662}$ 7	$77\overline{)2002}$ 2	$78\overline{)2262}$ 3	$71\overline{)2272}$ 3	$52\overline{)1820}$ 3
6.	$84\overline{)4284}$ 5	$85\overline{)5695}$ 7	$83\overline{)6889}$ 8	$94\overline{)4042}$ 4	$66\overline{)4686}$ 7
7.	$97\overline{)4074}$ 4	$94\overline{)6486}$ 7	$63\overline{)3591}$ 5	$47\overline{)3901}$ 9	$74\overline{)3182}$ 4

A Mistake to Avoid

Sometimes in **trying** quotient answers, we make a mistake in multiplying. We think our trial quotient is wrong, and we try another answer. How can we tell when we make a mistake? Let us see.

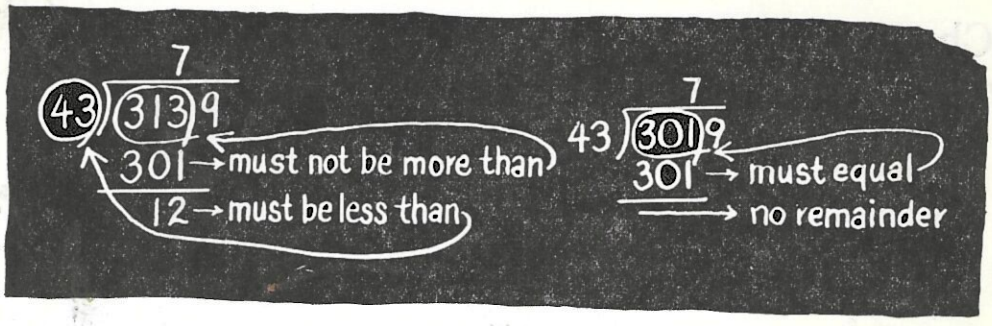
```
   7      9      8      7
34)2788  306  (282)  238
 238          ?
```

In dividing 2788 by 34, we notice that there are no 34's in 27. Our first question is "How many 34's in 278?" We think of the 3 (tens) as 3, and think, "Threes in twenty-seven, nine." We try 9 by multiplying, as shown at the side of the example. Since 9 is too large, we try 8 by multiplying. Suppose we make a mistake in multiplying by 8, or for some other reason we try 7 by multiplying. Our product is 238. Since 238 is **less than the number above it,** we have some reason to think that 7 is the true quotient answer. But our trial is not complete until we subtract. Let us subtract, and then let us examine our work closely.

```
   7
34)2788
 238
  40

   8
34)2788
 272
   6
```

Look at the remainder. It is **greater** than the divisor, not **less**, as it should be; so we know that 7 is the wrong quotient answer. We must try a higher number than 7. We try 8, and this time we multiply carefully and correctly. Our product, 272, is less than the number above it. We subtract and notice that the remainder is less than the divisor. We now know that 8 is the true quotient answer; so we bring down the next figure and go ahead.



How to Try a Quotient Answer

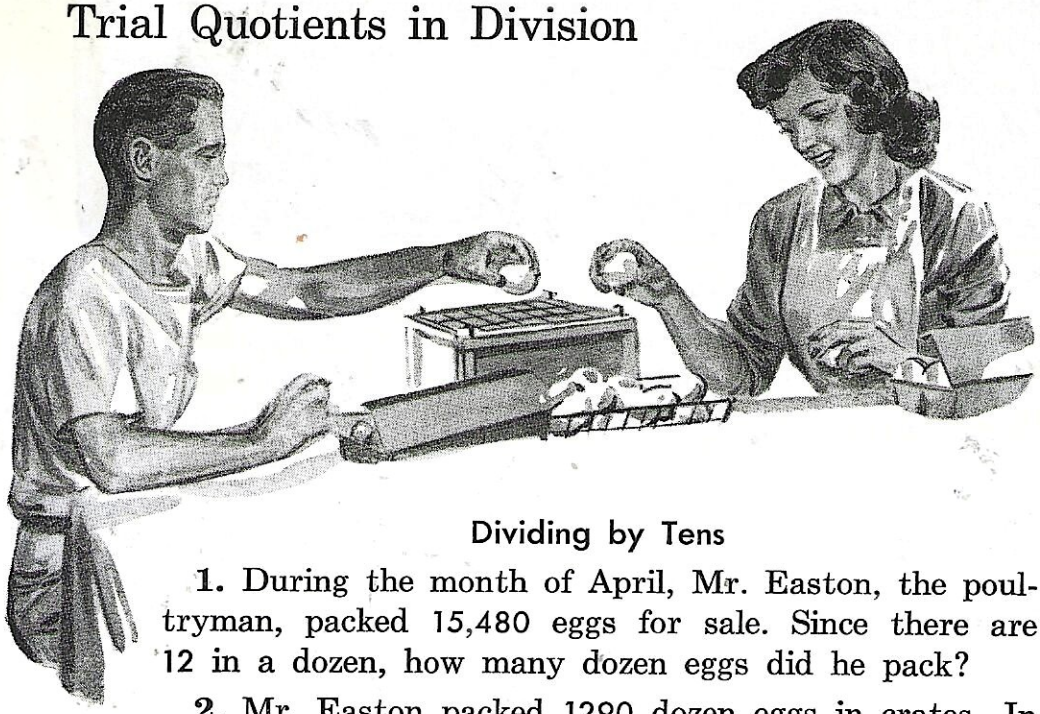
1. Multiply the divisor by the trial quotient.
2. Notice the product.
   a. If the product is larger than the number above it, try the next smaller number as a quotient answer, and so on.
   b. If the product is the same as the number above it, the trial answer is the true answer.
3. Subtract.
4. Notice the remainder.
   a. If the remainder is larger than the divisor, the trial quotient answer is too small. Try the next larger number as a quotient answer.
   b. If there is no remainder, the trial answer is the true answer.
   c. If the remainder is less than the divisor, the trial answer is the true answer.

Summary

Notice the product and the remainder.

The product must be the same as the number divided and with no remainder, or the product must be less than the number divided and with a remainder which is less than the divisor.

Chapter 15
Trial Quotients in Division

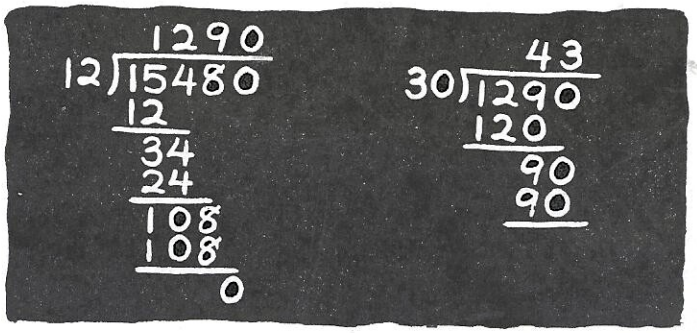


Dividing by Tens

1. During the month of April, Mr. Easton, the poultryman, packed 15,480 eggs for sale. Since there are 12 in a dozen, how many dozen eggs did he pack?

2. Mr. Easton packed 1290 dozen eggs in crates. In each crate he put 30 dozen eggs. How many crates did he pack?

Study the way Jim worked each of the above problems.



3. John had 1104 pennies saved that he wanted to put into rolls of 50 each before he took them to the bank. How many rolls of 50 pennies could he make? How many pennies would he have left over?

4. John had saved his nickels, too. He had 527 nickels. He put them into rolls of 40 each. How many rolls of 40 nickels did he have? Did he have any nickels left over? If so, how many?

5. John's brother Peter had saved dimes for a year. He had 785 dimes. He put them in rolls of 50 each. How many rolls of 50 dimes did he have? Were there any dimes left over? How many?

Keep an eye on the figure in ten's place in the divisor. Use it to find the trial quotient. Divide by tens and ones the way you divide by ones.

Copy and divide:

	(*a*)	(*b*)	(*c*)	(*d*)	(*e*)
6.	$84\overline{)4536}$	$21\overline{)1092}$	$44\overline{)1056}$	$61\overline{)4087}$	$73\overline{)4015}$
7.	$85\overline{)1020}$	$42\overline{)1176}$	$54\overline{)1458}$	$71\overline{)6745}$	$83\overline{)7553}$
8.	$95\overline{)3515}$	$43\overline{)2752}$	$55\overline{)3960}$	$72\overline{)3312}$	$84\overline{)5460}$
9.	$22\overline{)1386}$	$37\overline{)1184}$	$61\overline{)4575}$	$73\overline{)3212}$	$85\overline{)1955}$
10.	$48\overline{)1488}$	$45\overline{)3195}$	$62\overline{)1364}$	$74\overline{)6956}$	$91\overline{)5915}$
11.	$43\overline{)2365}$	$55\overline{)4455}$	$72\overline{)4032}$	$84\overline{)6384}$	$75\overline{)4575}$
12.	$23\overline{)989}$	$44\overline{)2376}$	$61\overline{)5063}$	$73\overline{)3312}$	$85\overline{)2890}$
13.	$32\overline{)1152}$	$45\overline{)2385}$	$62\overline{)2108}$	$74\overline{)6142}$	$91\overline{)6916}$
14.	$33\overline{)2673}$	$51\overline{)3978}$	$63\overline{)3969}$	$95\overline{)2945}$	$76\overline{)3344}$

Dividing by Tens and Ones

1. Mr. West says that his car averages about 14 miles to a gallon of gasoline. Yesterday he drove his car 42 miles. About how many gallons of gasoline did he use?

First Trial

$$14\overline{)42}\quad 4,\ 56$$

Second Trial

$$14\overline{)42}\quad 3,\ 42$$

Check

$$14 \times 3 = 42$$

To answer the question that the problem asks, we divide 42 by 14.

We think, "How many 14's are in 42? There are about as many 14's in 42 as there are 1's in 4." We write 4 in our answer.

We try 4. We call it the trial quotient. We multiply 14 by 4 and get 56. We write 56 under 42. Now we compare 56 and 42. We see that 56 is larger than 42; so we know the trial quotient, 4, is too large.

We try 3. We multiply 14 by 3 and get 42. We see that 42 is not too large; so we know that 3 is the true quotient.

Mr. West used about 3 gallons of gasoline.

> Sometimes when we divide, the first number that we try in the answer is too large. When this happens, we try the next smaller number.

2. Tell which trial quotients below are too large:

A	B	C	D	E
$13\overline{)52}$ 5, 65	$15\overline{)60}$ 6, 90	$23\overline{)96}$ 4, 92	$14\overline{)56}$ 5, 70	$13\overline{)42}$ 4, 52

3. Jane has 150 pieces of candy to pack in boxes. She can pack 25 pieces in each box. How many boxes will she fill with candy?

4. Jim needs a car to drive to and from work. He can pay $35 a month on the car. He found a used car for $245. How many months will it take him to pay for the car?

5. Tom and his father sold a load of oats in town yesterday. The oats weighed 1504 pounds. A bushel of oats weighs 32 pounds. How many bushels did they sell?

$$\begin{array}{r} 47 \\ 32\overline{)1504} \\ 128 \\ \hline 224 \\ 224 \\ \hline \end{array}$$

6. There are 435 pupils in our school. The fifth-grade children are making programs for the play they are going to give. Each of the 29 pupils in the fifth grade plans to make the same number of programs. How many should each of them make?

7. Jack kept a record of the family car for 28 days. He found that the car was driven 1148 miles. How many miles was that per day on the average?

8. Jim and Joe planned to drive to California. They estimated the distance at about 600 miles. "If we drive day and night, we can make it in 1 day. We have to average only _____ miles per hour, and that's easy."

Copy and divide:

	(*a*)	(*b*)	(*c*)	(*d*)	(*e*)
9.	$34\overline{)918}$	$23\overline{)1794}$	$72\overline{)2808}$	$65\overline{)5460}$	$22\overline{)1848}$
10.	$25\overline{)1075}$	$34\overline{)1292}$	$23\overline{)1541}$	$45\overline{)2025}$	$34\overline{)1632}$
11.	$62\overline{)2852}$	$49\overline{)1813}$	$81\overline{)1296}$	$38\overline{)2052}$	$52\overline{)4940}$

Two Trial Answers

1. Betty is planning to make curtains for her room. She finds that she needs 648 inches of curtain material. How many yards does she need? (36 in. = 1 yd.)

FIRST PART		SECOND PART	
First Trial	*Second Trial*	*First Trial*	*Second Trial*
2 36)648 72	1 36)648 36 28	19 36)648 36 288 324	18 36)648 36 288 288

2. The 36 pupils in our room sold 972 Christmas seals. What was the average number sold by a pupil?

3. There are 650 books in the room, and there are 25 children in the room. What is the average number of books for each pupil?

4. Jim raises rabbits and sells them. He has 512 rabbits in 16 pens. How many rabbits on the average are in each pen?

5. Jack read in the encyclopedia that a fast dog can run 795 feet in 15 seconds. How far is that in 1 second?

6. A milkman delivered 1704 quarts of milk to 24 customers in one month. What was the average number of quarts of milk delivered to each customer?

Copy and divide:

	(*a*)	(*b*)	(*c*)	(*d*)	(*e*)	(*f*)
7.	13)481	44)3872	65)4810	48)2016	27)675	24)912
8.	57)2736	48)2736	34)1836	45)3960	74)4958	33)957

Two or More Trial Quotients

Notice the trial quotients that were tried before the true quotient was found in each example below:

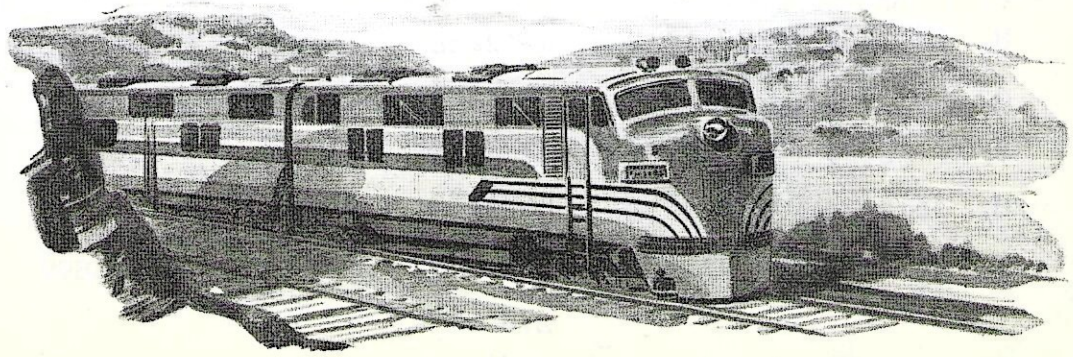
True Quotients	*Mental Trials*		*True Quotients*	*Mental Trials*		
4	6	5	5	8	7	6
16)64	96	80	17)85	136	119	102
64			85			
45	6	5	64	8	7	
27)1215	162	135	26)1664	208	182	
108			156			
135	6		104	5		
135	162		104	130		

1. The Limited Express travels 1800 miles in 24 hours. How many miles per hour does it go on the average?

2. Mr. Wells has 1015 tulip bulbs. If he plants 29 bulbs in each row, how many full rows will he have?

Copy and divide:

	(*a*)	(*b*)	(*c*)	(*d*)	(*e*)
3.	19)437	38)1786	28)1288	35)2730	25)1400
4.	86)4042	25)1850	69)5482	29)174	27)189
5.	48)3744	37)2109	27)1053	16)1008	29)1044



Washington's Birthday

1. Our class is going to make 400 paper hats for the party on Washington's birthday. There are 25 of us in the class. How many hats should each of us make?

2. There are 25 of us to share equally the cost of the party. If the total cost is \$8.50, how much should each of us pay as our share?

Copy and divide:

	(*a*)	(*b*)	(*c*)	(*d*)	(*e*)
3.	$22\overline{)1408}$	$38\overline{)1064}$	$54\overline{)3456}$	$70\overline{)4410}$	$19\overline{)1368}$
4.	$86\overline{)3784}$	$64\overline{)4288}$	$23\overline{)1679}$	$55\overline{)3025}$	$33\overline{)1551}$
5.	$71\overline{)3479}$	$87\overline{)2871}$	$72\overline{)5616}$	$24\overline{)1968}$	$65\overline{)1625}$
6.	$56\overline{)2576}$	$72\overline{)2736}$	$88\overline{)1848}$	$25\overline{)2275}$	$94\overline{)2444}$
7.	$57\overline{)2109}$	$73\overline{)1971}$	$89\overline{)1068}$	$93\overline{)6324}$	$69\overline{)4899}$

The Largest Trial Quotient

1. There are 25 boys in the Bird Club. They have 225 cards for the children in their school to sign. When the children sign the cards, they promise to feed and water the birds during the long winter days. The members of the club decided to divide the cards equally. How many cards should each member take?

We notice there are no 25's in 22; so our first question is "How many 25's are in 225?"

We think, "Twos in 22, 11." But 9 is the largest trial quotient we can use. We try 9.

$$25\overline{)225}\quad 9,\ 225$$

> A trial quotient cannot be larger than 9.

2. The 14 girls in our class want to divide equally 126 tickets to sell. How many should each girl take?

3. Study these examples. Tell how each is worked.

$$23\overline{)2139}\quad 93,\ 207,\ 69,\ 69$$

$$37\overline{)3626}\quad 98,\ 333,\ 296,\ 296$$

$$17\overline{)1530}\quad 90,\ 153,\ 0$$

$$28\overline{)2576}\quad 92,\ 252,\ 56,\ 56$$

Copy and divide:

	(a)	(b)	(c)	(d)	(e)
4.	$23\overline{)2001}$	$28\overline{)812}$	$27\overline{)783}$	$48\overline{)4368}$	$23\overline{)207}$
5.	$59\overline{)531}$	$24\overline{)2016}$	$28\overline{)2548}$	$12\overline{)1188}$	$45\overline{)4050}$
6.	$33\overline{)3036}$	$51\overline{)3672}$	$87\overline{)3045}$	$63\overline{)1008}$	$75\overline{)4275}$

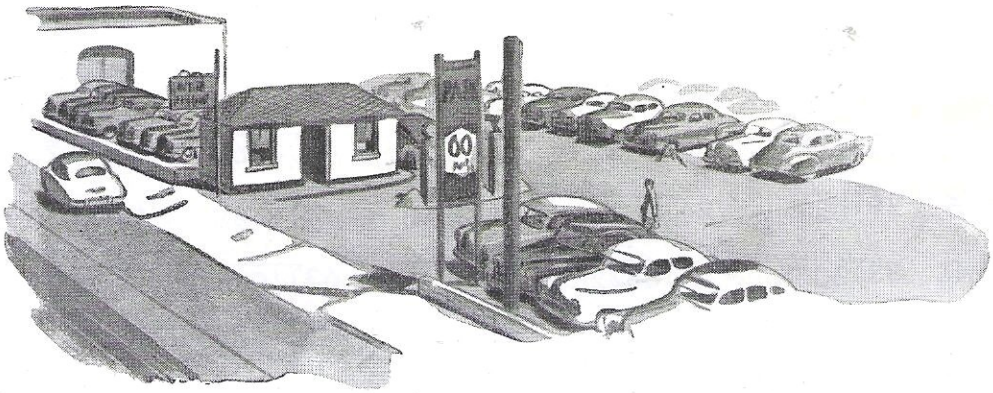
Practicing Division

Keep an eye on the figure in ten's place in the divisor. Divide by tens and ones the way you would divide by ones.

Copy and divide:

	(a)	(b)	(c)	(d)	(e)
1.	$10\overline{)9650}$	$42\overline{)1176}$	$74\overline{)1184}$	$27\overline{)702}$	$13\overline{)1274}$
2.	$59\overline{)1121}$	$91\overline{)4459}$	$12\overline{)984}$	$44\overline{)2024}$	$47\overline{)1363}$
3.	$76\overline{)5232}$	$29\overline{)1334}$	$61\overline{)3599}$	$93\overline{)2511}$	$75\overline{)2400}$
4.	$14\overline{)896}$	$46\overline{)2944}$	$78\overline{)4992}$	$31\overline{)1581}$	$26\overline{)1248}$
5.	$63\overline{)4851}$	$95\overline{)9025}$	$16\overline{)736}$	$48\overline{)3936}$	$89\overline{)6408}$
6.	$80\overline{)3920}$	$33\overline{)2409}$	$65\overline{)6175}$	$97\overline{)7081}$	$34\overline{)1462}$
7.	$18\overline{)504}$	$50\overline{)2350}$	$82\overline{)7216}$	$35\overline{)3325}$	$58\overline{)5088}$
8.	$67\overline{)1876}$	$20\overline{)5680}$	$52\overline{)4264}$	$84\overline{)5544}$	$28\overline{)1512}$
9.	$37\overline{)1369}$	$69\overline{)2829}$	$22\overline{)1408}$	$54\overline{)3456}$	$36\overline{)2268}$
10.	$86\overline{)3784}$	$39\overline{)741}$	$71\overline{)3479}$	$24\overline{)1968}$	$94\overline{)4042}$
11.	$88\overline{)1848}$	$41\overline{)779}$	$73\overline{)1971}$	$56\overline{)2576}$	$62\overline{)5828}$

12. There are 1190 cars parked in 14 rows in the parking lot. How many cars are in each row?



Using Zeros in Division

We know that zero is used to hold a place. In dividing, the zero will often help by **putting each part of the answer in its proper place.**

1. The first question is "How many 65's in 329?" Look at the 6 and at the 32, and think, "Sixes in thirty-two, five." Write 5, multiply, notice the product, subtract, and notice the remainder.

```
  507
65)32955
   325
   455
   455
```

Bring down the next figure. 65's in 45? We can see that there are no 65's in 45. We know that we have no number to write in ten's place; so we write 0 in the answer to keep the place. The zero will keep the other parts of the answer in their proper places.

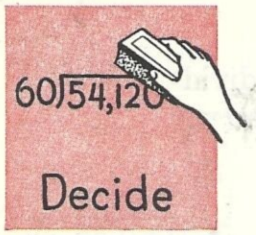
Bring down the next figure. 65's in 455? Look at the 6 and at the 45, and think, "Sixes in forty-five, seven." Write 7, and multiply.

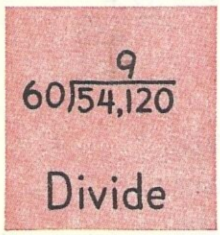
2. The first question is "How many 65's in 370?" Look at the 6 and at the 37, and think, "Sixes in thirty-seven, six." Try 6. Since that is too much, try 5. Multiply, notice the product, subtract, and notice the remainder.

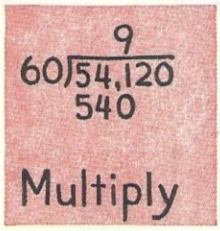
```
  570
65)37050
   325
   455
   455
     0
```

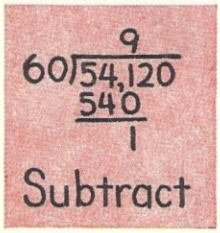
Bring down the next figure. 65's in 455? Look at the 6 and at the 45, and think, "Sixes in forty-five, seven." Write 7, and multiply. Notice the product.

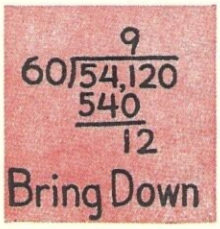
Since there is no remainder, bring down the next figure, which is zero. This means that there are no ones to be divided, that the answer is **hundreds** and **tens**, and that there are **no ones** in the answer. Write 0 in the answer to keep the rest of the answer in place.











Practicing Division

Copy and divide:

	(a)	(b)	(c)
1.	60)54,120	50)7850	40)2680
2.	80)56,480	80)72,320	90)63,270
3.	26)15,756	34)30,838	41)16,646
4.	59)53,336	67)40,602	75)38,100
5.	91)73,164	95)48,260	86)34,830
6.	65)26,585	57)23,028	44)31,064
7.	65)18,915	57)35,454	44)41,316
8.	28)16,968	16)12,928	25)15,250
9.	28)21,560	16)14,720	25)11,775
10.	17)6460	33)24,156	49)44,737
11.	96)81,120	80)39,520	66)55,490
12.	70)42,280	90)72,540	56)22,904
13.	83)74,783	78)37,744	36)32,544
14.	88)32,648	38)23,142	38)25,042

15. An air pilot flew his plane 2916 miles in 27 hours. What was his average speed per hour?

16. How many busses, each seating 32 passengers, will be needed to take 640 pupils to the fair?

17. Mr. Thomas drove his car 3090 miles in 15 days. How many miles did he drive each day on the average?

Dividing Dollars and Cents

In dividing dollars and cents, we work the example as we would work any other example in division.

We place the point (.) in the quotient directly over the point in the dividend, and we write the dollar sign ($) before the first quotient figure.

Be sure to write each part of the answer **in its proper place** and to place the point correctly.

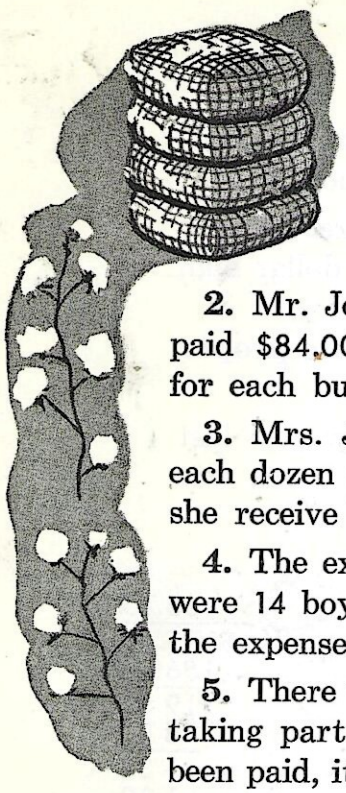
1. Henry's father received $175.50 as wages last month. He worked 26 days last month. How much was his wage each day?

Notice that we divide $175.50 by 26 the way we would divide 17550 by 26. Notice, also, that we are careful to put the point (.) in the answer just over the point (.) in the dividend.

$$
\begin{array}{r}
\$6.75 \\
26\overline{)\$175.50} \\
156 \\
\hline
195 \\
182 \\
\hline
130 \\
130 \\
\hline
\end{array}
$$

Copy and divide:

	(*a*)	(*b*)	(*c*)	(*d*)
2.	$15\overline{)\$83.85}$	$31\overline{)\$160.89}$	$47\overline{)\$345.92}$	$17\overline{)\$163.54}$
3.	$63\overline{)\$489.51}$	$79\overline{)\$434.50}$	$95\overline{)\$907.25}$	$68\overline{)\$501.16}$
4.	$16\overline{)\$74.56}$	$32\overline{)\$200.96}$	$48\overline{)\$397.44}$	$45\overline{)\$413.55}$
5.	$64\overline{)\$554.24}$	$80\overline{)\$394.40}$	$96\overline{)\$810.24}$	$39\overline{)\$204.75}$
6.	$56\overline{)\$683.20}$	$27\overline{)\$789.75}$	$72\overline{)\$224.64}$	$26\overline{)\$218.66}$
7.	$83\overline{)\$487.21}$	$52\overline{)\$294.32}$	$29\overline{)\$567.53}$	$51\overline{)\$140.25}$



Problems

1. Mr. Calvert raised 82 bales of cotton last year. It cost him $1029.92 to have it picked. How much did it cost him to have each bale picked?

2. Mr. Johnson sold 48 bushels of seed corn. He was paid $84.00 for it. How much was Mr. Johnson paid for each bushel of seed corn?

3. Mrs. Jackson sold 79 dozen eggs for $35.55. For each dozen she was paid the same price. How much did she receive for each dozen?

4. The expenses of a football trip were $72.10. There were 14 boys on the trip, and they had agreed to share the expenses equally. What was each boy's share?

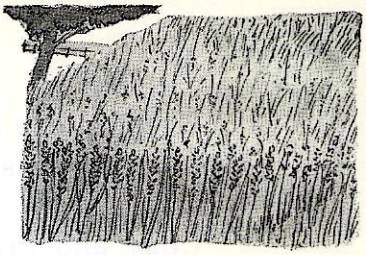
5. There were 15 rooms of pupils in the Adams School taking part in a school festival. After all expenses had been paid, it was found that $375 had been made. If each room got an equal share, how much did each room get?

6. A certain girls' club has 45 members. They collect $33.75 each year as dues. How much does each member pay as dues each year?

7. An automobile dealer bought 14 used cars at a total cost of $9450. How much was the cost of each car on the average?

8. The dealer bought 25 sets of seat covers at a total cost of $181.25. How much was the cost of each set of seat covers?

9. Bob earned $78.65 during his summer vacation, which was 13 weeks. How much did he earn each week on the average?



Problems

1. Mr. Henderson grew 456 bushels of wheat on 24 acres of land. How many bushels did he grow on each acre on the average?

2. A farmer had an apple orchard in which 1152 trees were planted in rows of 24 trees each. How many rows of trees are in his orchard?

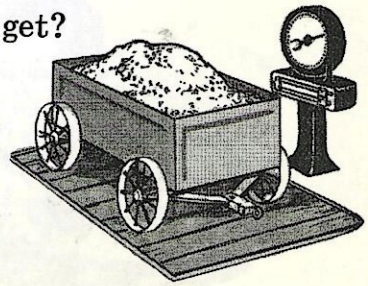
3. There are 1440 trees in an apple orchard. In each row there are 32 trees. How many rows of trees are there in the orchard?

4. The boys on a 6-man football team weigh 113 lb., 121 lb., 146 lb., 109 lb., 115 lb., and 98 lb. What is the average weight of the boys on the team?

5. The distance by train from Bristol to Memphis is about 555 miles. At the rate of 37 miles an hour, how long will it take a train to make the trip?

6. The Lock family took a long automobile trip on their vacation. They traveled 4875 miles in 25 days. What was the average number of miles they traveled each day?

7. The principal of the Auburn School divided 2584 packages of seeds equally among the 17 classes in the school. How many packages did each class get?



8. Jack and his father loaded a wagon with oats. When it was weighed, they found that there were 1568 pounds on the wagon. If there are 32 pounds to the bushel, how many bushels of oats were on the wagon?

Practicing Division

Keep an eye on the figure in ten's place in the divisor. Divide by tens and ones the way you would divide by ones.

Copy and divide:

	(a)	(b)	(c)	(d)	(e)
1.	$26\overline{)416}$	$58\overline{)1624}$	$90\overline{)5580}$	$11\overline{)1001}$	$27\overline{)2268}$
2.	$43\overline{)1591}$	$75\overline{)6825}$	$28\overline{)1036}$	$60\overline{)2280}$	$35\overline{)2765}$
3.	$92\overline{)3496}$	$13\overline{)949}$	$45\overline{)2475}$	$77\overline{)5621}$	$67\overline{)6231}$
4.	$30\overline{)2520}$	$62\overline{)4278}$	$94\overline{)1504}$	$15\overline{)1275}$	$48\overline{)2640}$
5.	$47\overline{)3431}$	$79\overline{)4345}$	$32\overline{)1984}$	$64\overline{)5504}$	$88\overline{)6248}$
6.	$96\overline{)8064}$	$17\overline{)1479}$	$49\overline{)4459}$	$81\overline{)8019}$	$91\overline{)4277}$
7.	$34\overline{)2856}$	$66\overline{)1254}$	$98\overline{)6076}$	$19\overline{)361}$	$52\overline{)3484}$
8.	$51\overline{)4641}$	$83\overline{)6391}$	$99\overline{)5049}$	$36\overline{)1656}$	$16\overline{)1520}$
9.	$68\overline{)2312}$	$21\overline{)1155}$	$53\overline{)3869}$	$85\overline{)4675}$	$37\overline{)3108}$
10.	$38\overline{)1064}$	$70\overline{)4410}$	$23\overline{)1679}$	$55\overline{)3025}$	$40\overline{)3920}$
11.	$87\overline{)2871}$	$72\overline{)2736}$	$25\overline{)2275}$	$57\overline{)2109}$	$73\overline{)2555}$

12. There are 1480 film slides in a box, divided into 20 rows. How many slides are there in each row?

How to Divide by Tens and Ones

1. Decide where to start writing the answer.

   a. Notice whether the first two figures in the dividend show a number which can be divided. The number can be divided when the first two figures show a number the same as the divisor or larger than the divisor.

   b. If the first two figures can be divided, write the first quotient answer above the second figure of the dividend.

   c. If the first two figures of the dividend show a number less than the divisor, write the first figure of the answer above the third figure of the dividend.

2. Divide. Think of the number to be divided as so many tens and of the divisor as so many tens. Think, "Threes in nine, three," and write 3 above the second figure of the dividend. Think, "Threes in twenty-two, seven," and write 7 above the third figure of the dividend.

3. Try the quotient answer that you get by multiplying, and notice the product. Do not try a quotient answer larger than 9.

4. Subtract and notice the remainder.

5. Bring down the next figure.

6. Divide again, as in 2.

7. Try the quotient answer, as in 3 and 4 until the example is finished.

$36\overline{)97}$ ↓

$36\overline{)2268}$ ↓

$\begin{array}{r} 3 \\ 36\overline{)97} \end{array}$

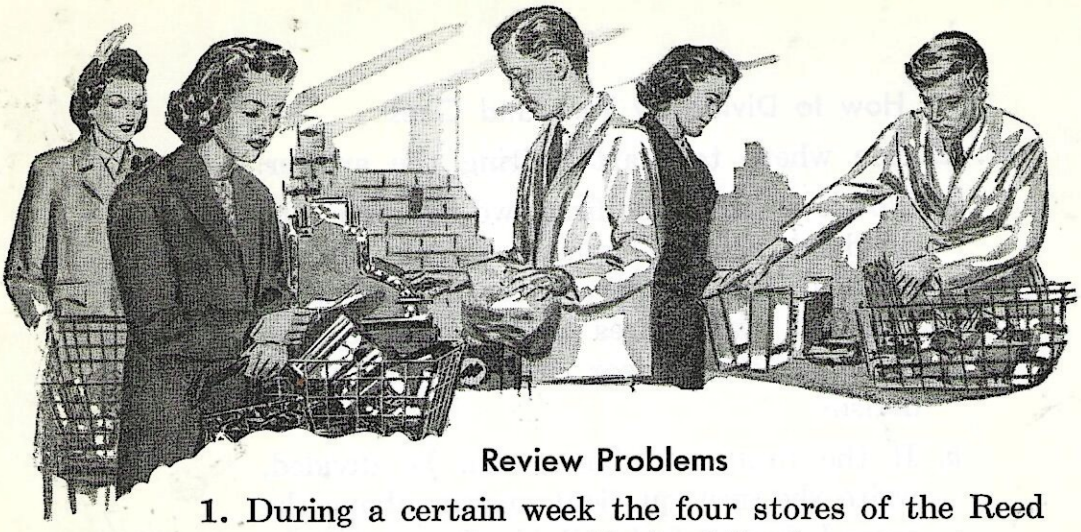
$\begin{array}{r} 7 \\ 36\overline{)2268} \end{array}$

$\begin{array}{r} 3 \\ 36\overline{)\ 97} \\ \underline{108} \end{array}$

$\begin{array}{r} 7 \\ 36\overline{)2268} \\ \underline{252} \end{array}$

$\begin{array}{r} 2 \\ 36\overline{)97} \\ \underline{72} \\ 25 \end{array}$

$\begin{array}{r} 63 \\ 36\overline{)2268} \\ \underline{216} \\ 108 \\ \underline{108} \end{array}$



Review Problems

1. During a certain week the four stores of the Reed Brothers Grocery Store sold the following amounts:

Store Number 1	$1382.76
Store Number 2	1061.04
Store Number 3	983.47
Store Number 4	1508.18

How much did all the stores sell that week?

2. On a certain day the company had $9704.68 in the bank. To pay a number of bills, the company drew out $3041.97. How much did the company have left in the bank?

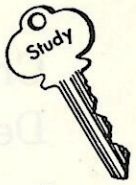
3. The company ordered 100 dozen cans of tomatoes from a canning factory. The tomatoes came packed 24 cans in a box. How many boxes were there?

4. The company ordered 288 boxes of canned peas. The peas came packed in boxes with 4 dozen cans in each box. How many cans of peas were ordered?

5. During the canning season for peaches, the company sold 385 bushel baskets of peaches at an average price of $2.65 a bushel. How much did the company receive for the peaches?

[Test]

Do You Need Practice?



Add and check:

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	
1.	632		800	9	15	92	$17.25	24	
	178	1962	1634	5	63	37	8.00	32	(17) (18)
	409	5039	35	7	47	05	45.39	15	
	86	2004	204	3	90	16	2.15	89	
	300	670	9	8	26	29	.98	74	
2.					$\frac{1}{2}$	$\frac{3}{4}$	$2\frac{1}{3}$	$1\frac{1}{2}$	
	$\frac{1}{8}$	$\frac{11}{12}$	$4\frac{1}{6}$	$8\frac{2}{3}$	$\frac{1}{4}$	$\frac{5}{8}$	$4\frac{3}{4}$	$3\frac{3}{8}$	(210) to (252)
	$\frac{3}{8}$	$\frac{5}{6}$	$6\frac{3}{4}$	$5\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{5}{6}$	

Subtract and check:

3.	504	800	913	760	400	1509	$325.80	$.71	(21) (22)
	162	45	216	183	174	890	75.92	.45	
4.	5	$6\frac{1}{2}$	$8\frac{2}{3}$	$7\frac{5}{8}$	$2\frac{1}{2}$	$4\frac{1}{3}$	$9\frac{3}{8}$	$7\frac{5}{6}$	(212) to (251)
	$\frac{3}{4}$	2	$3\frac{2}{3}$	$\frac{3}{8}$	$1\frac{2}{3}$	$2\frac{5}{12}$	$5\frac{3}{4}$	$1\frac{1}{2}$	

Multiply and check:

5.	436	705	247	861	105	82	$40.27	$.35	(34) to (43)
	82	90	45	94	6	9	8	7	
6.	500	600	580	509	958	347	197	25	
	80	50	71	25	48	96	72	82	

Divide and check:

	(a)	(b)	(c)	(d)	(e)	(f)	
7.	$63\overline{)1575}$	$19\overline{)893}$	$27\overline{)18954}$	$54\overline{)18360}$	$35\overline{)2467}$	$93\overline{)6310}$	(192) to (194)
8.	$29\overline{)1102}$	$8\overline{)736}$	$9\overline{)1071}$	$6\overline{)3642}$	$7\overline{)672}$	$8\overline{)6448}$	(60) to (62)

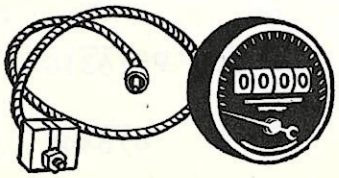
Chapter 16
Decimals as Measures

A Present for Bob

Bob's parents gave him a new bicycle on his birthday. He was so pleased with the gift that he wrote his uncle about it. His uncle wrote back that he was sending a **cyclometer** for Bob to attach to his bicycle.

"What is a cyclometer?" asked Bob.

His father said, "Wait until it comes. Then perhaps you can find out what it is and what it is used for."



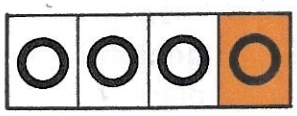
This is the way the cyclometer looked when it came and before Bob's father fastened it on the new bicycle.

What is a cyclometer? How is it used?

A New Way to Write Fractions

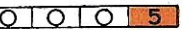
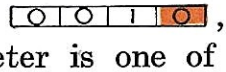
"A cyclometer," explained Bob's father, "is an instrument to measure the distance you travel on your bicycle. Now it registers zero miles. Get on your bicycle and ride down to the park entrance. Look at the cyclometer when you get there, and then ride back."

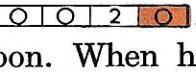
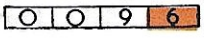
"What does the cyclometer register?" asked his father when Bob returned from his ride to the park entrance.



"It shows 10 miles," said Bob, "but I know that isn't correct. It is only a half mile to the park, and to the park and back would be just one mile and not ten miles."

"When I got to the park entrance," continued Bob, "I looked at the cyclometer, and it showed 5 miles when it should have shown only a half mile."

Bob's father explained that the cyclometer was made to show not only miles but tenths of a mile. When the cyclometer reads  , it shows 5 tenths of a mile. When it reads  , it shows 1 and no tenth miles. The cyclometer is one of many modern instruments that measure in tenths. As it measures a tenth, it adds that tenth to what has already been measured.

Bob rode down to the park entrance and back. When he returned, the cyclometer read  . After lunch Bob rode most of the afternoon. When he came home in the evening, the cyclometer read  .

How far did Bob ride that afternoon?

How far did he ride that day?

Writing Tenths in Tenth's Place

Just as we write **ones in one's place,**
tens in ten's place, and
hundreds in hundred's place,
so we write **tenths in tenth's place.**

In order to write tenths in tenth's place, we use a **decimal point** (.) to show where we mean tenth's place to be. Tenth's place is next to and just to the right of the point.

In order to show:	*We write:*
Five tenths	.5
Eight tenths	.8
One tenth	.1
Nine tenths	.9
One and five tenths	1.5
Six and eight tenths	6.8
Fifteen and one tenth	15.1
Sixty-five and nine tenths	65.9

Write as decimals:

a. Six tenths
b. Thirty and six tenths
c. Fourteen and five tenths
d. One and two tenths
e. One tenth
f. Seven tenths
g. Ten and seven tenths
h. Eleven and one tenth
i. Three tenths
j. Fifty-two and two tenths

When we write tenths as decimals, we show both **number of parts** and **size of parts.** Thus, when we write **five tenths,** we write the figure *5* to show number, and we put it in tenth's place with the point (.5) to show size.

Reading Decimal Fractions

One tenth may be written in two ways: $\frac{1}{10}$ or .1.

When we write one tenth as $\frac{1}{10}$, we call it a **common fraction.** When we write one tenth as .1, we call it a **decimal fraction.** Often we just say that $\frac{1}{10}$ is a **fraction**, and .1 is a **decimal.**

We read $2\frac{3}{10}$ as two and three tenths, and we read 2.3 as two and three tenths. We say that $2\frac{3}{10}$ is a **mixed number**, and we say that 2.3 is a **mixed decimal.**

Read these decimals:

.1 .4 .3 .8 .5 .7 .2 .6 .9

Read these mixed decimals. Remember the decimal point is always read **and.**

4.2 5.6 10.2 15.8 7.9 8.5 11.7 9.9

Write these decimals and mixed decimals as some boy or girl reads them. When he reads, "Five and six tenths," you write 5.6. The **and** tells you where to put the point. It tells where the whole number ends and the decimal begins.

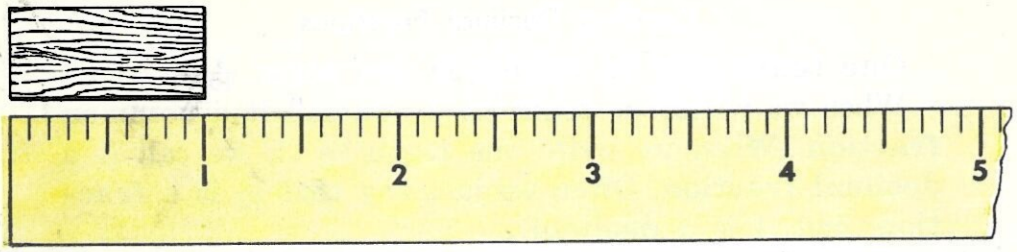
10.8 9.5 6.4 85.5 6.1 75.3 84.6 99.9

TEMPERATURE CHART

8 a.m.	100.3
Noon	99.9
4 p.m.	101.5
8 p.m.	99.4
Midnight	98.6

Railroad Mileage Chart

Chicago	0.0
Evanston	12.1
Winnetka	16.7
Highland Park	23.2
Waukegan	35.9
Kenosha	51.6
Racine	61.9
Milwaukee	85.0

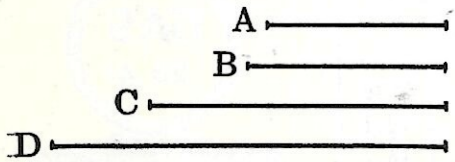


Measuring in Tenths

The picture shows part of a foot ruler, 12 inches long. Each inch is marked off into **10 tenths** of an inch. The picture shows how the ruler is used to measure the width of the block of wood in **tenths** of an inch.

How wide is the block? Count the tenths: one tenth, two tenths, and so on. The block is 10 tenths of an inch wide. Of course, 10 tenths ($\frac{10}{10}$) of an inch make 1 inch. But instead of writing the width as 1 inch, we write it as 1.0 inch. 1.0 means 1 inch, but it also means that the inch width was measured in tenths.

To write the width as 1 inch means that the width was measured as accurately as possible in **whole inches**. To write the width as 1.0 inch means that it was measured as accurately as possible in **tenths** of an inch.



Line A measures .9 inch.
Line B measures 1.0 inch.
Line C measures 1.5 inches.
Line D measures 2.0 inches.

Thus, we know that the four lines were measured as accurately as possible in tenths of an inch. Line D is 2 inches long, but it does not tell us how accurately it was measured. Line D is 2.0 inches long. This tells that it was measured very carefully in tenths.

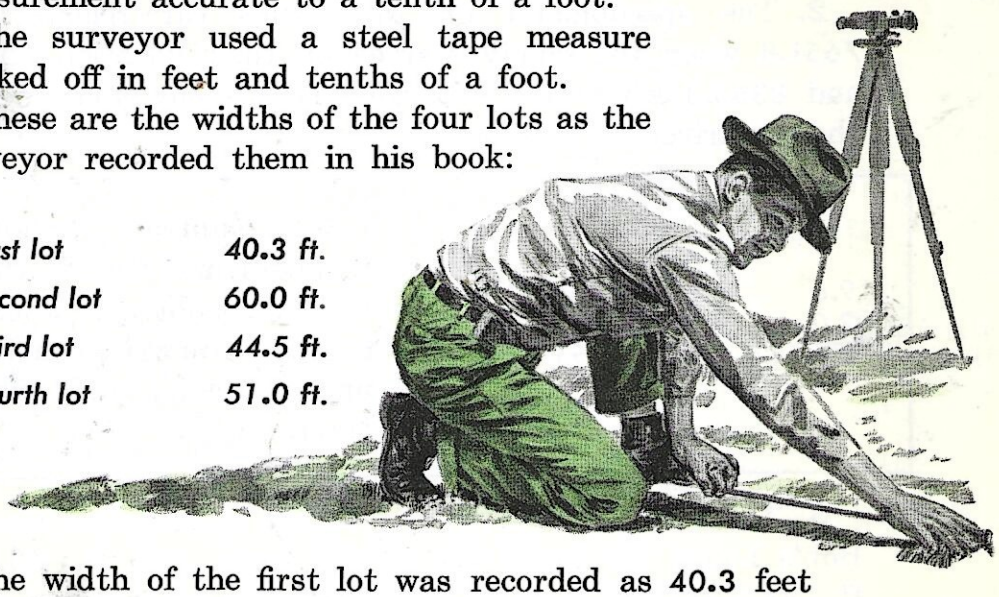
Decimals as Measures

A surveyor measured four lots near Bob's house. The lots were valuable; so he measured the widths and lengths of them very carefully and tried to get each measurement accurate to a tenth of a foot.

The surveyor used a steel tape measure marked off in feet and tenths of a foot.

These are the widths of the four lots as the surveyor recorded them in his book:

First lot	*40.3 ft.*
Second lot	*60.0 ft.*
Third lot	*44.5 ft.*
Fourth lot	*51.0 ft.*



The width of the first lot was recorded as 40.3 feet because the width was closer to 40.3 feet than it was to 40.2 feet or 40.4 feet. The width of the second lot was 60 feet. The surveyor wrote the width as 60.0 feet to show that he had measured it to the nearest tenths. Actually, the width was just a tiny bit less than 60 feet, but since it was more than half a tenth wider than 59.9 feet, he recorded its width as 60.0 feet. The third lot was slightly more than 44.5 feet, but it was closer to 44.5 than it was to 44.4 or 44.6 feet. The fourth lot was exactly 51 feet wide, as near as the surveyor could measure it. To show that he was measuring in tenths, he recorded the width as 51.0 feet.

Adding and Subtracting Tenths

1. The cyclometer on Bob's bicycle registered 2.0 miles at noon and 9.6 miles in the evening. How many miles did Bob ride in the afternoon?

2. The speedometer on Mr. Bell's car registered 7651.8 when the family started on their vacation trip and 8365.3 when they returned. How many miles was the car driven on the trip?

9.6 2.0 7.6 miles	8365.3 7651.8 713.5 miles	We subtract whole numbers and tenths the way we subtract whole numbers. We write **tenths** under **tenths** and subtract.

3. A surveyor measured the widths of four lots near Bob's house. He found the widths were: 40.3 ft., 60.0 ft., 44.5 ft. and 51.0 ft. What was the total width of the four lots?

40.3 60.0 44.5 51.0 195.8 ft.	We add whole numbers and tenths the way we add whole numbers. We write **tenths** under **tenths** and add.

4. Add:

25.6 ft.
31.2 ft.
28.4 ft.

5. Add:

40.8 ft.
39.6 ft.
45.0 ft.

6. Subtract:

98.6 mi.
73.4 mi.

7. Subtract:

195.8 ft.
76.9 ft.

Adding and Subtracting Tenths

Tenths are added and subtracted the way **ones, tens,** and **hundreds** are added and subtracted. But we must be careful to write each number **in its proper place—tenths** under **tenths, ones** under **ones, tens** under **tens,** and so on.

Add:

	(a)	(b)	(c)	(d)	(e)	(f)
1.	47.6	8.6	.4	108.3	27.5	18.2
	82.4	7.2	.8	74.6	110.4	73.5
	31.0	9.0	1.0	95.0	72.0	6.3
	57.2	12.5	.7	82.1	18.7	41.0
2.	28.5	15.4	.9	35.6	40.8	13.8
	17.9	10.8	1.2	28.9	18.6	14.9
	24.7	9.5	1.0	32.3	20.4	11.2
	20.3	11.0	1.5	30.7	18.8	12.5

Subtract:

3.	57.9	28.5	46.8	124.5	106.3	138.2
	42.6	24.3	35.0	95.5	82.8	91.9
4.	97.0	478.3	129.0	96.3	80.2	76.8
	65.3	283.5	57.6	62.7	57.6	9.9
5.	28.3	1.5	1.0	7.2	72.5	64.5
	20.5	.8	.4	.6	18.6	35.7

6. The school nurse used the scales that weigh in tenths of a pound. Jane weighed 75.4 lb., Alice weighed 80.5 lb., Susan weighed 76.3 lb., and Beth weighed 82.8 lb. What is the total weight of the girls?

Multiplying and Dividing Tenths

1. Last Saturday Bob had to make 3 trips to the store. The distance there and back is 2.4 miles. How many miles did Bob ride in going to and from the store?

$$\begin{array}{r} 2.4 \\ \times\ 3 \\ \hline 7.2 \end{array}$$

Multiply the way you would multiply a whole number. In the answer, place the point to show **tenths**. Bob rode 7.2 miles.

2. The total width of the 4 lots Mr. Horner bought measured 211.2 feet. What is the average width?

$$\begin{array}{r} 52.8 \\ 4\overline{)211.2} \\ 20 \\ \hline 11 \\ 8 \\ \hline 32 \\ 32 \\ \hline \end{array}$$

Divide the way you would divide a whole number. In the answer, place the point over the point in the dividend.

The answer is 52.8 feet.

Multiply:

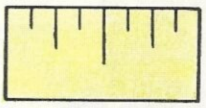
	(a)	(b)	(c)	(d)	(e)	(f)
3.	24.7 × 2	92.1 × 4	8.5 × 6	17.4 × 8	20.5 × 7	42.3 × 43
4.	15.7 × 31	35.2 × 25	61.6 × 7	28.4 × 9	14.6 × 12	91.6 × 5

Divide:

	(a)	(b)	(c)	(d)	(e)
5.	$5\overline{)289.0}$	$6\overline{)44.4}$	$9\overline{)264.6}$	$8\overline{)281.6}$	$4\overline{)168.4}$
6.	$7\overline{)59.5}$	$4\overline{)106.8}$	$25\overline{)437.5}$	$12\overline{)631.2}$	$5\overline{)210.5}$

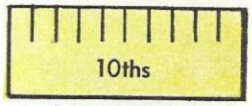
More Accurate Measurement

In 1 foot there are 12 inches; so 1 inch is $\frac{1}{12}$ of a foot. One tenth (.1) of a foot is slightly longer than $\frac{1}{12}$ of a foot, or 1 inch.



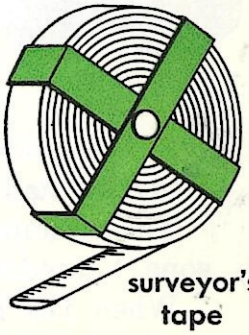
1 inch

The .1 foot, shown here, is divided into ten equal parts. Each of the ten equal parts of the .1 foot is one tenth of one tenth foot long, or one hundredth foot long. When we measure in hundredths, we measure more accurately than when we measure in tenths.



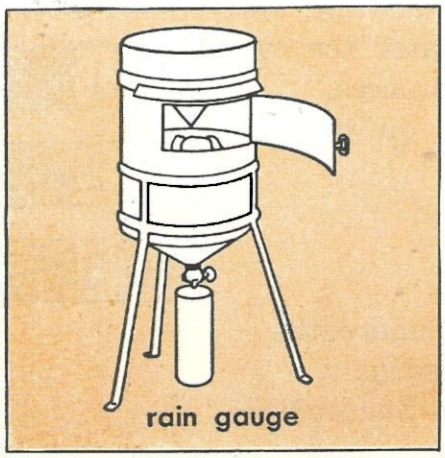
One tenth foot

We measure valuable city lots in hundredths of a foot. To measure in hundredths of a foot, the surveyor uses a steel tape. On this tape each foot is marked off in tenths, and each tenth is marked off in tenths. Thus, the tape is marked off in tenths and tenths of tenths, or hundredths.

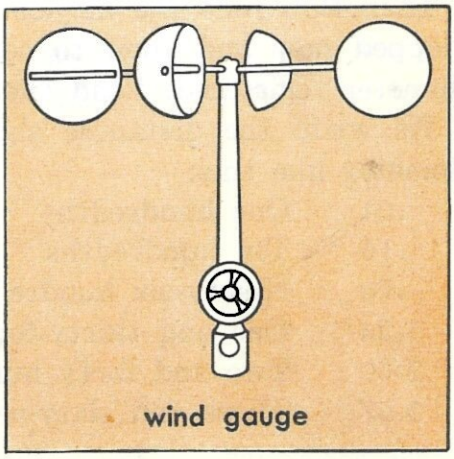


surveyor's tape

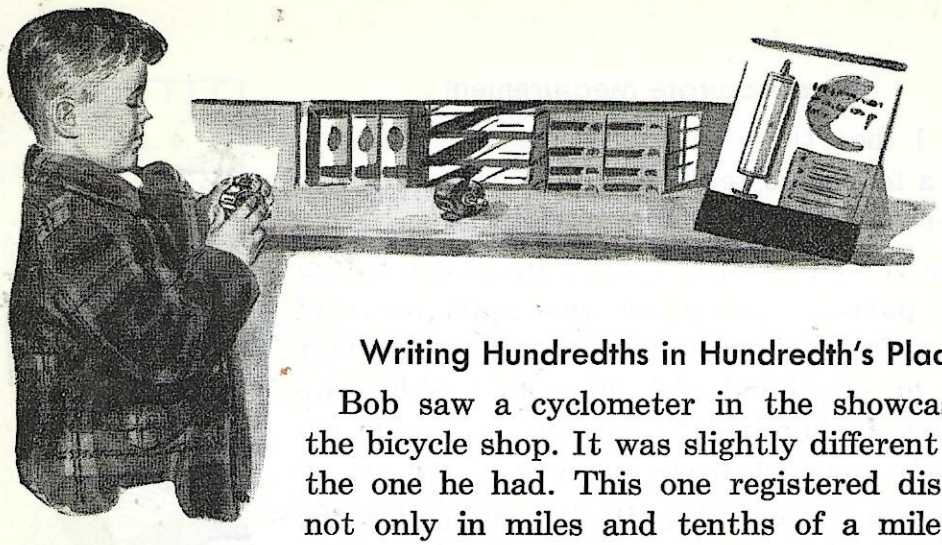
The weatherman catches the rain as it falls in a special container. He tells us in hundredths of an inch how much rain has fallen.



rain gauge



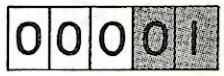
wind gauge



Writing Hundredths in Hundredth's Place

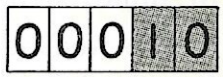
Bob saw a cyclometer in the showcase at the bicycle shop. It was slightly different from the one he had. This one registered distance not only in miles and tenths of a mile, but also in hundredths of a mile.

A boy rode the bicycle with this cyclometer on it. When he had ridden a short distance, it read:

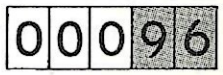


The cyclometer showed that the bicycle had gone 1 hundredth of a mile.

When the bicycle had gone 10 hundredths of a mile, the cyclometer read:



The cyclometer showed that the bicycle had gone 1 tenth, or 10 hundredths, of a mile.



Then Bob rode the bicycle for a while. He stopped now and then to see what the cyclometer registered. Read the distances.

We write the distances shown on the cyclometer like this:

.01	One hundredth
.10	Ten hundredths
.96	Ninety-six hundredths
1.34	One and thirty-four hundredths
2.40	Two and forty hundredths
3.67	Three and sixty-seven hundredths

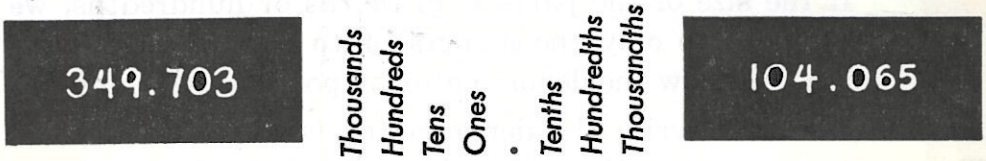
The Meaning of Numbers

Each figure in a number tells both number and value. Let us look at 276. The 6 is in the first place. The value of this place is one. So our number, 276, has 6 ones. What is the value of the second place? How many tens does our number have? What is the value of the third place? How many hundreds does our number have? What does the number 276 mean?

Hundreds	Tens	Ones
2	7	6

The value of each place is how many times as much as the place to its right? The value of each place is what part of the place to its left?

Our number system is a system of tens.



One's place is the center of our number system. For each place to the left of one's place, there is a place to the right, whose name is about the same. The place to the left of ones is tens, and the place to the right of ones is tenths. Two places to the left of ones is hundreds, and two places to the right of ones is hundredths.

We read .6 as six tenths. .6

We read .58 as fifty-eight hundredths. .58

We read 3.45 as three **and** forty-five hundredths. 3.45

We read 14.605 as fourteen **and** six hundred five thousandths. 14.605

Kinds of Fractions

Fractions are parts of a whole.
The denominator tells the size of the parts.
The numerator tells the number of parts.

Common fractions are the fractions of common everyday use. We speak of, and write, $\frac{1}{2}$ pound butter, $\frac{7}{8}$ inch thickness of a board, and so on.

The ruler the carpenter uses to measure lengths, widths, and thicknesses of board is marked off in whole inches, and in halves, fourths, eighths, and sixteenths. He may wish to saw off a piece of board 4 ft. $3\frac{1}{4}$ in. long. With his ruler he measures 4 ft. and 3 in. and $\frac{1}{4}$ in. more.

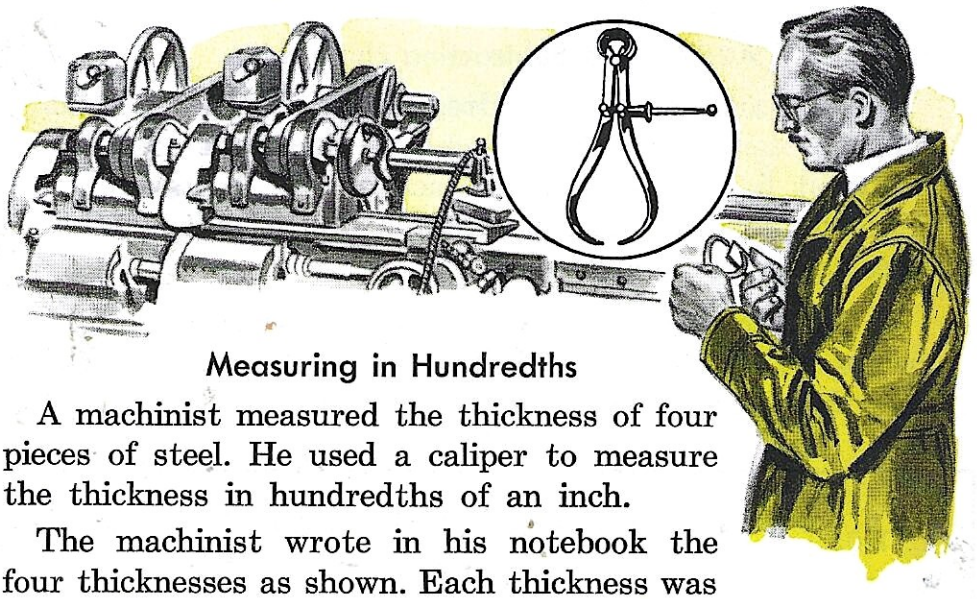
If the size of the parts is in tenths or hundredths, we need to write only the numerator to tell the number of parts. We show the denominator by position, as .1 and .01.

When we write the denominator, we call the fraction a **common fraction**. Fractions like $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, and $\frac{7}{8}$ are common fractions.

When we show the denominator by the position of the numerator, the fraction is a **decimal fraction**. We usually call it a decimal. Fractions like .1, .5, .08, and .20 are decimals.

Three hundredths
- as a common fraction is $\frac{3}{100}$.
- as a decimal fraction is .03.

Decimal fractions are the fractions of accurate measurement. Thus, an inch is marked off in tenths or in hundredths so that we can measure to the nearest tenth or to the nearest hundredth.



Measuring in Hundredths

A machinist measured the thickness of four pieces of steel. He used a caliper to measure the thickness in hundredths of an inch.

The machinist wrote in his notebook the four thicknesses as shown. Each thickness was measured accurately to a hundredth of an inch. The first thickness was just a shade less than one and five hundredths inches, but since it was nearer one and five hundredths than one and four hundredths, he wrote the thickness as 1.05.

1.05 in.
.92 in.
1.20 in.
.80 in.

The second thickness was nearer ninety-two hundredths than ninety-three hundredths.

The third thickness was almost exactly one and twenty hundredths. Instead of writing 1.2 inches, he wrote 1.20 inches to show that he had measured in hundredths and not in tenths.

The fourth thickness was more than halfway between seventy-nine hundredths and eighty hundredths. The machinist wrote the thickness as .80 instead of .8 to show that the measurement was accurate to a hundredth of an inch.

Adding and Subtracting Hundredths

We add and subtract hundredths the way we add and subtract tenths, and ones, and tens, and hundreds. But we must be careful to write each answer in its proper place: hundredths under hundredths, tenths under tenths, ones under ones, and so on.

1. The thicknesses of four pieces of steel were 1.05 inches, .92 inches, 1.20 inches, and .80 inches. What was the total thickness of the four pieces?

1.05 .92 1.20 .80 3.97 in.	We are careful to write each number in its proper place—hundredths under hundredths, tenths under tenths, and ones under ones. Then we add the way we add whole numbers.

2. The owner of the bicycle shop loaned Bob for a week's trial a cyclometer that registered in hundredths. At the beginning of the week the cyclometer registered 3.67 miles, and at the end of the week it registered 18.82 miles. How many miles did Bob ride his bicycle that week?

18.82 3.67 15.15 miles	We are careful to write each number in its proper place. Then we subtract the way we subtract whole numbers.

Adding and Subtracting Hundredths

In adding and subtracting hundredths, or tenths and hundredths, be sure to write each number in its proper place.

Add:

	(a)	(b)	(c)	(d)	(e)	(f)
1.	.87	2.67	2.28	5.07	.86	57.36
	.92	3.04	.40	4.80	2.43	9.87
	1.07	2.90	.37	5.23	1.05	20.02
	.90	3.28	.32	4.96	4.17	5.08
2.	32.40	.73	2.85	5.18	41.37	1.10
	36.09	.60	3.40	6.74	167.25	14.75
	35.00	.84	3.04	4.90	8.60	20.50
	30.68	.69	2.91	5.20	25.90	38.85

Subtract:

3.	7.68	.97	.68	1.46	63.50	100.25
	4.25	.30	.48	.82	32.98	46.75
4.	6.50	5.09	8.00	16.24	81.06	121.02
	2.36	4.21	2.07	8.36	24.65	53.64
5.	38.40	.84	2.91	6.74	135.60	42.50
	23.75	.28	1.76	4.87	92.50	27.65
6.	67.20	9.71	8.64	19.23	123.54	37.45
	18.59	7.88	3.25	10.79	91.99	16.82

7. The heaviest rainfall in twenty-four hours in New York City in the last seventy years was 9.40 inches on October 8, 1903. The next heaviest was 6.17 inches on September 23, 1882. How much more was the rainfall on October 8, 1903, than on September 23, 1882?

Multiplying Tenths and Hundredths

PRACTICE

64.8 × 6

80.6 × 5

10.8 × 8

67.3 × 4

72.4 × 9

1. Bob's father owns 3 lots in the new addition to the city. Each lot, when it was surveyed, measured 62.5 feet in width. How wide were the lots altogether?

62.5 ft. 3 187.5 ft.	We multiply tenths the way we multiply whole numbers. We are very careful to put the point (.) so that the answer will have each number in its proper place.

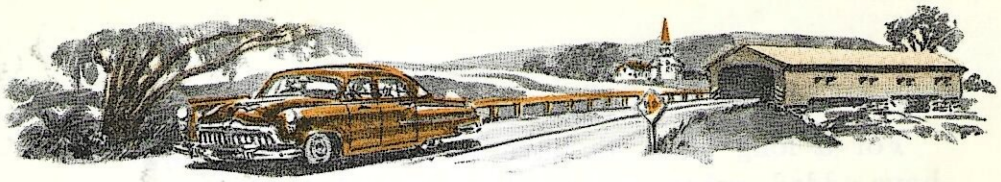
2. A machinist measured the thickness of 5 pieces of steel. The thickness of each piece was .28 inches. What was the combined thickness of all the pieces?

.28 in. 5 1.40 in.	We multiply hundredths the way we multiply whole numbers. We are very careful to write each part of our answer in its proper place.

When we multiply tenths by a whole number, we must place the point in our answer to show tenths. When we multiply hundredths by a whole number, we must place the point in our answer to show hundredths.

3. Copy and multiply:

(*a*)	(*b*)	(*c*)	(*d*)	(*e*)	(*f*)	(*g*)
2.03 × 7	89.04 × 4	1.82 × 8	50.17 × 6	6.91 × 3	46.85 × 5	40.36 × 6



Dividing Tenths and Hundredths

1. Mr. Jackson drove his car 92.5 miles on 5 gallons of gas. How many miles did he get per gallon?

We divide tenths the way we divide whole numbers. We write each part of the answer in its proper place. We put the point in the answer just above the point in the dividend.

$$5\overline{)92.5} = 18.5$$

5
42
40
25
25

2. During a week of rainy weather the rainfall in a certain town was 18.76 inches. What was the average number of inches of rainfall per day?

We divide hundredths the way we divide whole numbers. We write each part of the answer in its proper place. We put the point in the answer just above the point in the dividend.

$$7\overline{)18.76} = 2.68$$

14
47
42
56
56

Copy and divide:

	(a)	(b)	(c)	(d)	(e)	(f)
3.	$4\overline{)38.04}$	$5\overline{)41.45}$	$7\overline{)6.86}$	$5\overline{)68.75}$	$6\overline{)39.12}$	$4\overline{)109.96}$
4.	$9\overline{)22.32}$	$4\overline{)14.24}$	$8\overline{)6.72}$	$9\overline{)81.45}$	$7\overline{)14.42}$	$8\overline{)20.48}$

Dollars and Cents

For a long time we have been writing decimals. We have added, subtracted, multiplied, and divided decimals. When we have worked with dollars and cents, we have worked with decimals. When we write \$3.75, we write 3 and 75 hundredths dollars, although we call it 3 dollars and 75 cents.

Add:

	(a)	(b)	(c)	(d)	(e)
1.	\$7.50 8.75 6.48 3.57	\$ .75 .50 1.25 2.60	\$17.80 25.63 19.82 20.07	\$1.85 .48 .63 2.05	\$50.00 14.86 5.10 68.37

Subtract:

2.	\$ .93 .65	\$46.50 24.75	\$75.00 28.63	\$168.50 76.25	\$100.00 86.14
3.	\$200.00 76.48	\$26.42 17.28	\$65.08 26.14	\$217.00 28.75	\$137.40 84.86

Multiply:

4.	\$ .75 36	\$4.65 18	\$18.36 45	\$7.28 19	\$17.65 16
5.	\$ .27 55	\$9.15 23	\$82.26 15	\$9.95 35	\$45.82 76

Divide:

6.	$6\overline{)\$34.50}$	$25\overline{)\$18.75}$	$25\overline{)\$208.50}$	$7\overline{)\$120.96}$	$2\overline{)\$10.04}$
7.	$9\overline{)\$78.48}$	$32\overline{)\$15.68}$	$71\overline{)\$104.15}$	$5\overline{)\$460.75}$	$8\overline{)\$18.16}$
8.	$7\overline{)\$72.38}$	$53\overline{)\$12.19}$	$47\overline{)\$241.11}$	$4\overline{)\$159.68}$	$9\overline{)\$17.28}$

Tom's Trip

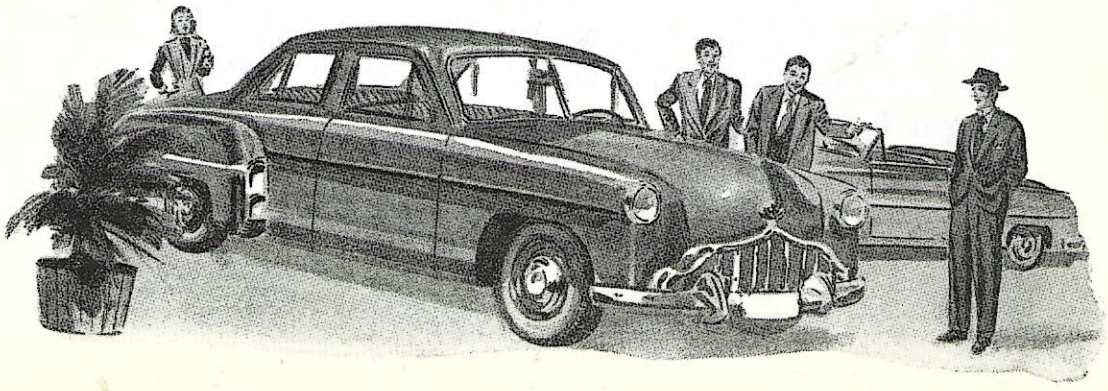
1. One Saturday Tom went on a trip with his father. When they started, the speedometer showed 3437.2. When they got back home, it showed 3606.8. How many miles did they travel?

2. As they started out, Mr. Clark bought 12 gallons of gasoline at 21¢ a gallon and 2 quarts of oil at 37¢ a quart. How much was Mr. Clark's bill at the filling station?

3. With the car that Mr. Clark now owns, he averages 15 miles to a gallon of gasoline. Did he have to stop on the trip to buy more gasoline?

4. Their lunch bill was $1.20, and their dinner cost $2.25. During the afternoon each had a 15¢ ice-cream soda. How much did they pay for food that day?

5. Mr. Clark's errand to the city was to talk to a car salesman about trading his old car for a new one. The car he wanted cost $1585. The salesman would allow Mr. Clark $565 for his old car. Then if he would pay $420 in cash, he could take the car and pay the rest of the amount in one year. If Mr. Clark paid the same amount each month, what would his monthly payments be?



Are You a Good Thinker?

1. John has a little instrument, called a pedometer, that shows how far he walks. One week he kept a record of the number of miles he walked each day. The record showed the following distances: Monday, 3.0 mi.; Tuesday, 3.4 mi.; Wednesday, 4.7 mi.; Thursday, 2.9 mi.; Friday, 4.2 mi.; Saturday, 5.6 mi.; Sunday, 4.9 mi. What was the average distance that he walked each day?

2. John's pedometer shows that he lives .7 miles from school. If he goes home for lunch, how many miles does he walk going to and from school each day? each school week?

3. Ellen has a Saturday job that pays 35¢ an hour. She usually works 4 hours a day. She wants to use one half of the money she earns each Saturday to pay for her own schoolbooks, which cost $5.38 this year. Can she finish paying for the books after working 7 Saturdays? 8 Saturdays?

4. Ben earns 25¢ an hour taking care of little Billy Adams on evenings that his parents go out. One evening Ben stayed from 5:30 p.m. until 11:30 p.m. How much did he earn that evening?

5. Allen helped Mr. West pick up his 80 bushels of potatoes. Mr. West agreed to pay Allen by giving him $\frac{1}{10}$ of the potatoes he picked up. Allen sold his share of the potatoes for $2.10 a bushel. How much money did he get for the job?

6. Ronnie gets 75¢ an evening helping Mr. Olds at the picture show. There are shows 6 days a week. How much does Ronnie make each week?

Practice with Decimals

Copy and multiply:

	(a)	(b)	(c)	(d)	(e)	(f)
1.	3.75 × 5	4.82 × 6	16.7 × 4	24.8 × 9	25.05 × 6	30.01 × 9
2.	62.4 × 3	8.17 × 7	2.58 × 8	46.3 × 2	36.10 × 8	40.40 × 12
3.	27.6 × 27	49.7 × 35	60.3 × 96	5.08 × 48	10.75 × 8	12.45 × 6
4.	6.18 × 91	.78 × 54	7.8 × 67	3.04 × 38	13.82 × 8	27.05 × 29

Copy and divide:

	(a)	(b)	(c)	(d)	(e)
5.	$5\overline{)40.85}$	$6\overline{)100.2}$	$4\overline{)19.28}$	$9\overline{)119.34}$	$45\overline{)247.5}$
6.	$3\overline{)82.8}$	$7\overline{)5.46}$	$8\overline{)206.4}$	$2\overline{)75.36}$	$58\overline{)74.24}$
7.	$43\overline{)27.52}$	$24\overline{)196.8}$	$16\overline{)258.88}$	$73\overline{)197.1}$	$24\overline{)43.68}$
8.	$37\overline{)225.7}$	$53\overline{)143.1}$	$69\overline{)164.91}$	$14\overline{)606.2}$	$86\overline{)31.82}$

Copy and add:

9. \$27.80 + \$90.69 + \$148.20 + \$400.75 + \$74.09
10. \$495.10 + \$.82 + \$11.14 + \$66.85 + \$10.00
11. \$13.09 + \$265.70 + \$29.95 + \$44.98 + \$70.03

Copy and subtract:

12. \$91.81 from \$100.00; \$73.84 from \$210.66
13. From \$80.00 subtract \$78.05
14. From \$893.72 subtract \$785.95

Their Rooms

Betty spoke up, "I am sure my room must be larger than Bob's."

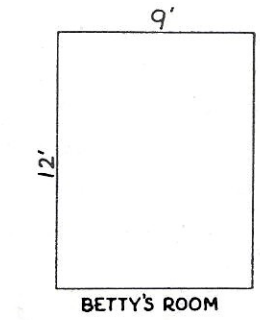
Bob answered, "No, I think my room is just as large as yours and maybe larger. Let's measure our rooms."

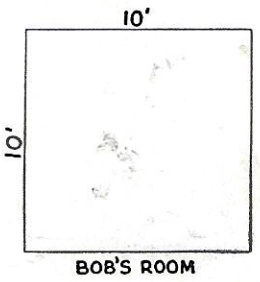
The children went inside and measured their rooms with the yardstick. Betty's room measured 12 feet long and 9 feet wide, and Bob's room measured 10 feet long and 10 feet wide.

Then they drew the floor plans of their rooms from the measurements.

"You are right," said Bob to Betty. "My room is wider than yours, but it is not as big as yours."

How could they tell which room was larger?





In trying to answer this question, let us review what we know about how to measure lengths and distances.

12 inches	**= 1 foot**	**36 inches**	**= 1 yard**
3 feet	**= 1 yard**	**5280 feet**	**= 1 mile**
$5\frac{1}{2}$ yards	**= 1 rod**	**1760 yards**	**= 1 mile**
$16\frac{1}{2}$ feet	**= 1 rod**	**320 rods**	**= 1 mile**

We know that the way to measure the amount of a certain thing is to take the right unit of measure and apply it to the thing to be measured. The way to measure liquids is to take the pint, quart, or gallon measure and **apply it** (count the times the liquid fills the pint, quart, or gallon measure). The way to measure lengths is to take the **inch, foot, yard,** or **rod measure** and to **apply it** (count the times the inch, foot, yard, or rod measure covers the length being measured).

Early Measures of Length

In olden times to measure a short length or distance, a person would use the length of his **foot** or his **feet** as a measure. He applied this measure by placing his feet heel to toe from one end of the length to the other, and by counting the times (feet) he set his feet down to cover the distance.

To measure longer distances, people used a **pole** or **rod** and applied it to the distance. Sometimes they used a **stick** of shorter length which they called a **yard**. The old meaning of yard is stick, rod, or measure. We still use the yardstick. The thing to remember is that people applied the rod, pole, yard, or foot just as we apply our measures today.

We can understand how the use of such measures led to many disputes about lengths and distances. The poles, rods, and sticks used were of different lengths. Two persons using different length sticks to measure a piece of land could easily get into a dispute about the size of the land. People's feet differed in size then as they do today so that two people could hardly settle a dispute about distance by stepping off the distance. Such disputes could not be avoided until the exact lengths of various measures (standards) were decided upon.

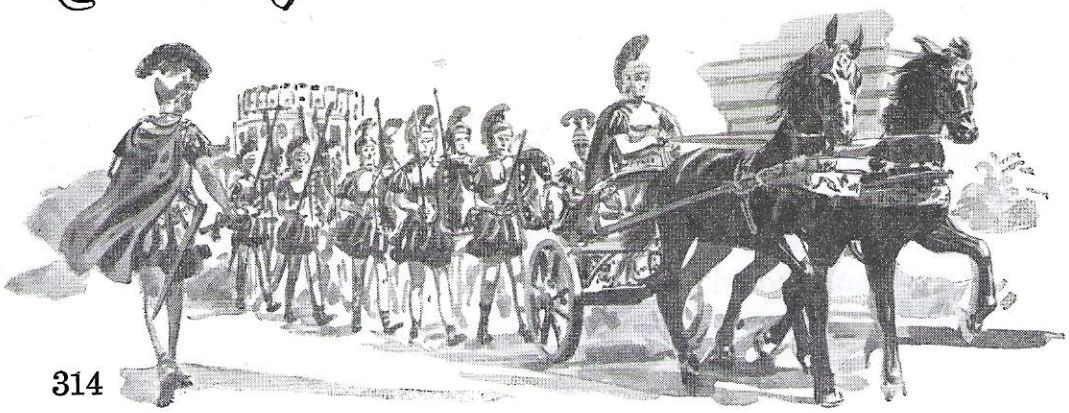
Measuring in Ancient Times

This ancient man has just traded some fish for a new fishing line. How long is the new line? To tell, he wraps it around his waist and measures its length as so many **girths**. A girth corresponds closely to our yard in length.

The **span** was used to measure short lengths. The span is the length from the tip of the thumb to the tip of the little finger of the outstretched hand.

The Roman soldier measured distances in **steps** and **paces**. The step of the soldier was about 30 inches or $2\frac{1}{2}$ feet. The pace was 2 steps or about 5 feet. The Roman mile was the distance marching troops would go in 1000 paces. Their mile was about 5000 feet, and our mile is 5280 feet.

Long before the foot ruler or the yardstick came into use, people used other methods of measurement. The length of some part of the body was often used as the unit of measure.



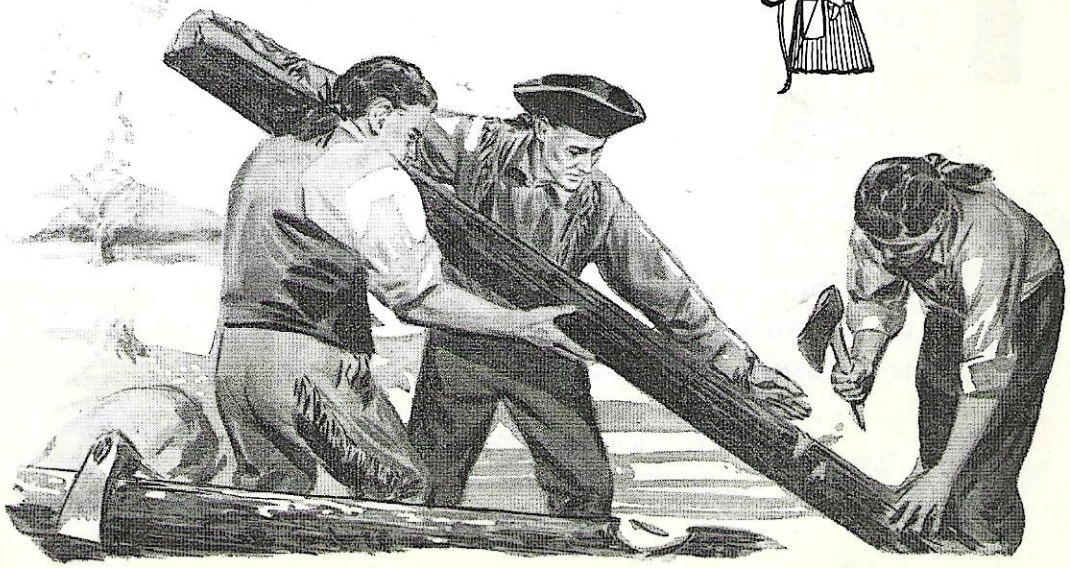
Measuring in Ancient Times

This ancient workman wants to saw off a block that is a **cubit** in length. He is measuring the length with his cubit. A cubit is the length from the point of the elbow to the tip of the middle finger.

This man wants to replace a log in his cabin. He wants to know how long the new log will have to be. He is measuring the length of his cabin in **fathoms**. A fathom is the length from finger tip to finger tip when the arms are outstretched.

From the tip of the middle finger of the outstretched arm to the middle of the chest is an **ell**, or a yard. An ell is one-half fathom.

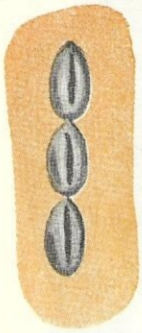
This bowman is trying out his arrow to see if it is an ell in length.



Present Measures of Length

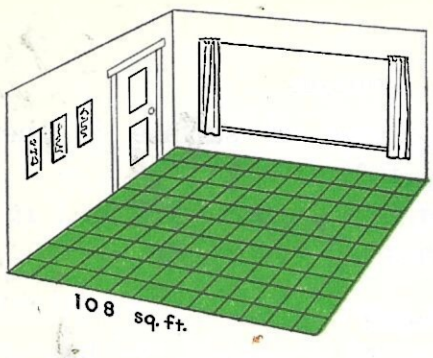
The **yard** of length, as we use it today, is the distance between two gold plugs in a certain bronze bar kept at Westminster in England. It is also the exact length of a metal bar kept at Washington, D.C. **All yard** measures are marked off from one of these so that the yard as we use it today is always the same length. Our other measures of length are related to the yard length. Five and one-half such lengths make one **rod**. One third of a yard is our **foot**, and a twelfth part of a foot is our **inch**. The word inch comes from a Latin word meaning *twelfth part.*

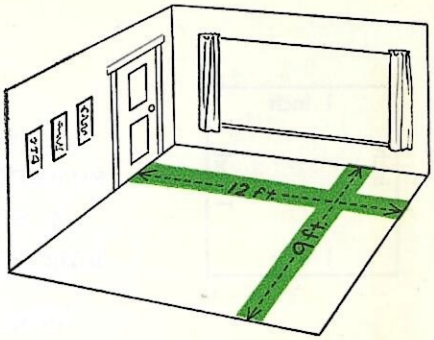
An old English law declared that the length of the inch must be that of "three grains of barley dry and round placed end to end." In early times they used to say, "3 barleycorns make one inch; 12 inches make one foot." It is interesting to notice that the old English law stated that grains of barley had to be placed end to end. It **applied** a grain of barley as a measure to tell how long an inch should be.



It took the people of former days a long time to agree on their use of measures of length so that they could have exact measures, such as we use today. They had to work out, or decide upon, a **measure of length** before they could measure length exactly. After they decided upon a measure, they **applied it**. Let us remember these two important steps which must be done in order to measure anything:

1. Decide upon a **measure.**
2. **Apply** the measure.





Surfaces

Bob and Betty were interested in the sizes of the whole vegetable garden, the whole playground, and all the space in their rooms, not just the lengths and widths of them. How big is Betty's room? Betty knew, when she had measured the room, that it was 12 feet long and 9 feet wide. What she really wanted to know was how big the **whole surface** of the floor is, not merely how big it is along two sides.

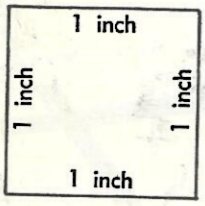
In measuring the garden, Bob measured first along one edge of it, then along another edge. But Bob wanted to know how big the **whole garden** is, not merely how big it is along its edges.

The garden, the playground, and the floors in the two children's rooms are **surfaces**, not lengths. A surface has length just as a piece of thread has length, but the **surface** of a garden is quite different from the **length** of a thread.

We must learn how to **measure surfaces.** In order to tell how big a **surface** is, we must do two things:

1. Decide upon a **measure of surfaces.**
2. **Apply** the measure.

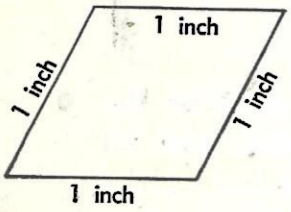
Let us now do each of these in turn.



Squares

A common measure of surface is the **square foot** (sq. ft.).

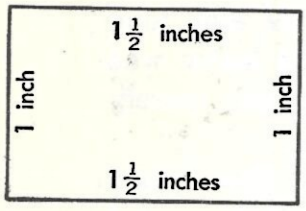
A **square foot** is a **square** that is 1 ft. long and 1 ft. wide.



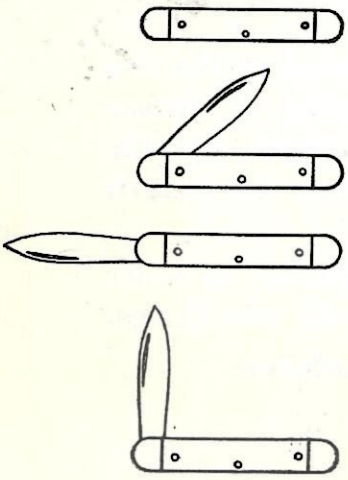
What is a square?

The first figure is a square. It has 4 **sides**. The sides are all the **same length.** It has **square corners.** This square is a **square inch** in size.

The second figure is *not a square.* It has 4 sides, and the sides are all the same length. But it does not have square corners.



A figure may have square corners and not be a square. Look at the next figure. It is *not a square.* It has 4 square corners, but the 4 sides are not the same length.



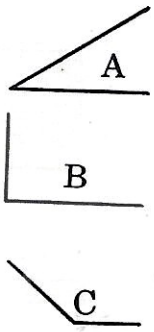
When Bobby's knife is **closed,** it looks like the picture at the left.

Here is his knife **partly opened.** Between the blade and the handle there is a **small opening.**

Here is his knife **wide open.**

And here is Bobby's knife **half opened.** The opening between the blade and the handle is half of what it is when the knife is wide open.

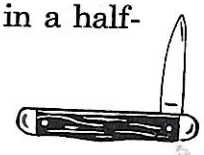
Learning about Angles



Between the lines in A, the opening is small. In B, it is larger, and in C the opening is still larger.

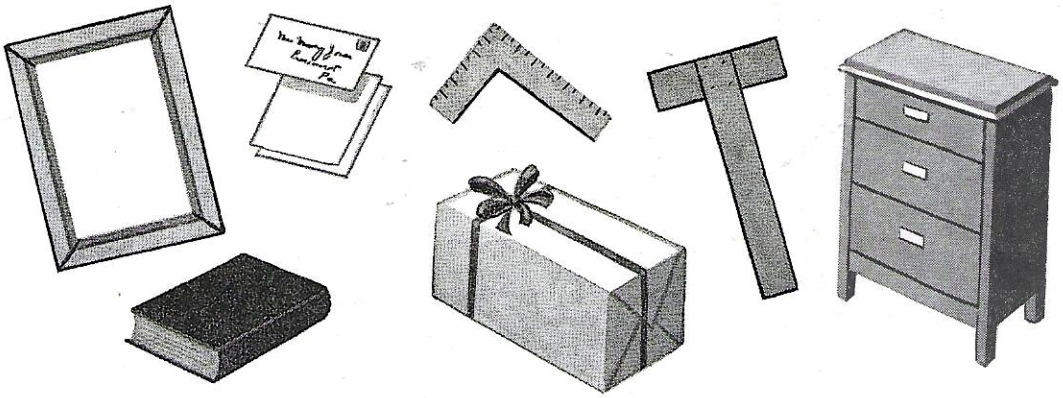
The opening between lines is called an **angle**. An opening, or an angle, as large as the one in B is called a **right angle**. The corner is square. The corners in A and C are not square; so the openings are angles but not right angles.

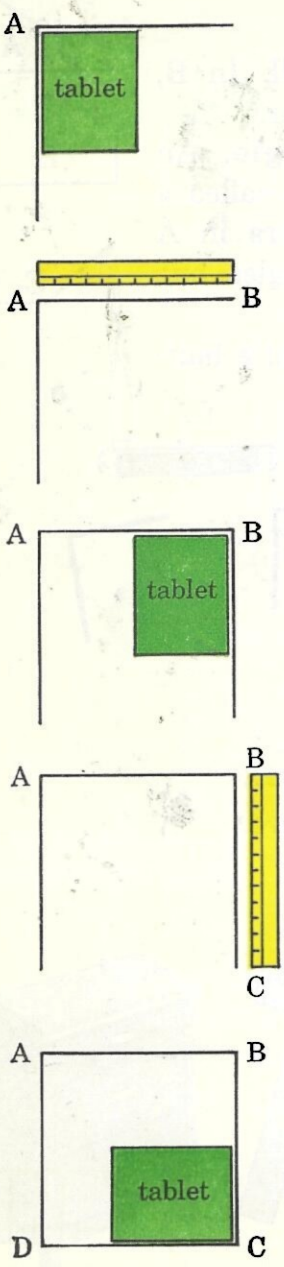
A right angle is an opening as large as that in a half-opened knife. Here are some right angles:



Draw a right angle on your paper.
Draw a right angle on the board.
Point to the right angle and the square corner.

Name some objects that have square corners. The pictures on this page may help you.





The Square Foot

Draw a square foot on a piece of cardboard.

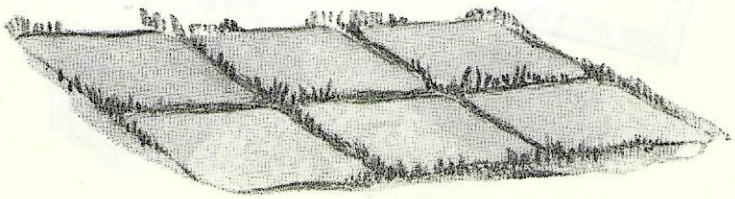
Use a square corner of your tablet to draw a right angle as shown in A. Take your ruler and draw a straight line 1 foot long to B. At B, place the square corner of your tablet with one edge along line AB, and draw a right angle with the line pointing to C. Draw line BC 1 foot long. Then draw a right angle at C as shown.

Now you have a square. It has 4 sides. The sides are the same length. The 4 corners are square, and the 4 angles are right angles.

You have a **square foot**, a square whose sides are each 1 foot long. You can use the square foot to measure the sizes of surfaces.

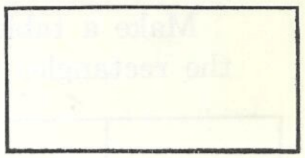
Which is nearest in size to a square foot, a Savings Stamp, a page of your book, the cover of your geography, a man's handkerchief, or the top of your desk?

The sidewalk in the picture is made of stone. Each stone is 1 foot on a side. This means that each stone covers exactly 1 square foot of surface. Six stones cover 6 square feet of surface. How many square feet of surface will 10 stones cover?



Applying the Square Foot Measure

A 4-sided figure with square corners is called a **rectangle**. A square is a rectangle. A square is a 4-sided figure with square corners, but in a square the sides are equal. So a square is a special kind of rectangle.



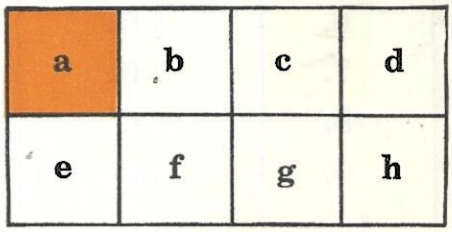
rectangle

square

1. Draw on the board a 4-sided figure with 4 square corners, 2 feet wide and 4 feet long.

How large is the rectangle you have drawn? How many square feet in size is it? We can measure it and see.

Place your square foot measure in one of the corners, as at **a**, and carefully mark the space it covers, or 1 square foot. Next, measure in the same way another square foot at **b**, and mark it.

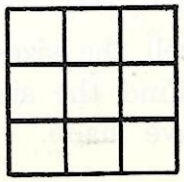


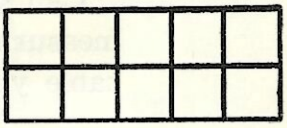
Do the same at **c**, then at **d**, **e**, **f**, **g**, and **h**. Now count the square feet you have measured in the rectangle that is 4 feet long and 2 feet wide.

There are 8 square feet in the rectangle.

2. Draw other rectangles on the board and on the floor, and measure the square feet in each:

a. 3 feet long and 3 feet wide
b. 4 feet long and 3 feet wide
c. 5 feet long and 2 feet wide
d. 4 feet long and 4 feet wide





Applying the Square Foot Measure

Make a table like the one below to show the sizes of the rectangles you have measured.

Number	Lengths of Sides		Size of Rectangle in Square Feet
	Feet Long	Feet Wide	
1.	4 ft.	2 ft.	8 sq. ft.
2.	3 ft.	3 ft.	9 sq. ft.
3.	4 ft.	3 ft.	12 sq. ft.
4.	6 ft.	2 ft.	12 sq. ft.
5.	4 ft.	4 ft.	16 sq. ft.
6.	5 ft.	2 ft.	10 sq. ft.
7.	5 ft.	3 ft.	15 sq. ft.
8.	5 ft.	4 ft.	
9.	6 ft.	3 ft.	
10.	6 ft.	4 ft.	

When Ned Barton was making his table, he had an idea. He said, "Really, you don't have to measure the square feet in a rectangle with your square foot measure. If you multiply the number of feet long by the number of feet wide, you will always get the number of square feet there are in the rectangle." Look at numbers 1 to 7 in your table. Was Ned correct?

Can you tell the sizes of rectangles 8 to 10 without measuring? Find the size of each, and record it in the table you have made.

Finding Sizes without Measuring

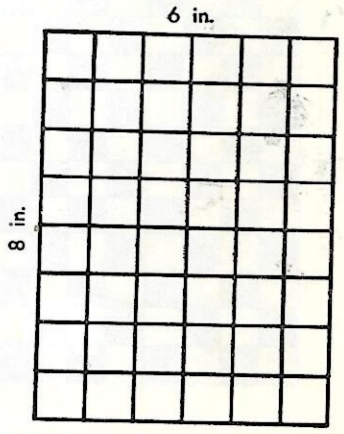
To find the size of a rectangle in square feet, multiply the number of feet long by the number of feet wide.

To find the size of a rectangle in square inches, multiply the number of inches long by the number of inches wide.

To find the size of a rectangle in square yards, multiply the number of yards long by the number of yards wide.

To find the size of a rectangle in square rods, multiply the number of rods long by the number of rods wide.

1. The back of Edna's tablet is 6 inches wide and 8 inches long. How big is it in square inches?



8	number of inches long
×6	number of inches wide
48	number of square inches

Edna found that the tablet back is 48 square inches in size.

Just to check, she marked off the back in square inches, as shown in the diagram, and counted the square inches. Is 48 square inches the correct answer?

2. The back of Elmer's tablet is 8 inches wide and 10 inches long. How big is the back of his tablet in square inches?

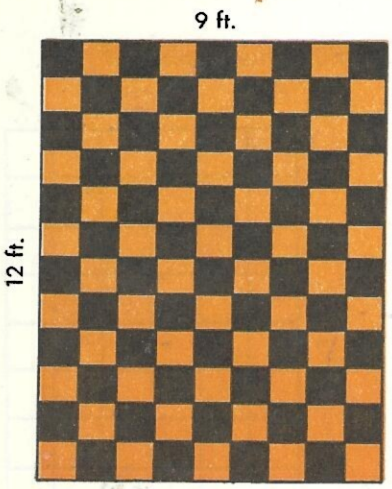
3. Betty's room is 12 feet long and 9 feet wide. How big is her room in square feet?

4. Bob's room is 10 feet long and 10 feet wide. How big is his room?

Finding Areas

The size of a surface is called its **area.** We find the areas of surfaces in square inches, square feet, square yards, square rods, and so on.

1. The kitchen in Bob's and Betty's house is 12 feet long and 9 feet wide. The linoleum the workman put on the floor is in foot squares, a red square, a black square, and so on. How many square feet of linoleum did it take to cover the floor?



2. How many square yards of linoleum did it take?

Draw a square yard on the board. Find the number of square feet in a square that is 1 yard or 3 feet long, and 1 yard or 3 feet wide.

9 square feet = 1 square yard.

12 ft.
×9 ft.
108 sq. ft.

$$9\overline{)108}\quad 12$$

In 9 sq. ft. there is 1 sq. yd.

In 108 sq. ft. there are 12 sq. yd.

4 yd.
×3 yd.
12 sq. yd.

Wilma said, "I know another way of finding the area of the linoleum in square yards. 12 feet long and 9 feet wide in yards would be 4 yards long and 3 yards wide. So 4 times 3 gives 12 square yards." Is she right?

Finding Areas

1. The playground at Bob and Betty's home is 30 feet wide and 50 feet long. How large is it in square feet?

2. The vegetable garden is 60 feet long and 27 feet wide. How large is it?

3. Which is larger, the garden or the playground? how much larger?

4. The lot on which the house is built is 60 feet wide and 180 feet long. How large is the lot in square feet?

5. How large is the lot in square yards?

6. Mr. Veasey bought a big roll of chicken wire to go around his chicken yard. The wire was 60 yards long and 2 yards wide. How many square yards of wire did he buy? How many square feet of wire did he buy?

7. Mr. Veasey owns a large lot at the edge of town. It is in the shape of a rectangle, 20 rods long and 16 rods wide. How large is the lot in square rods?

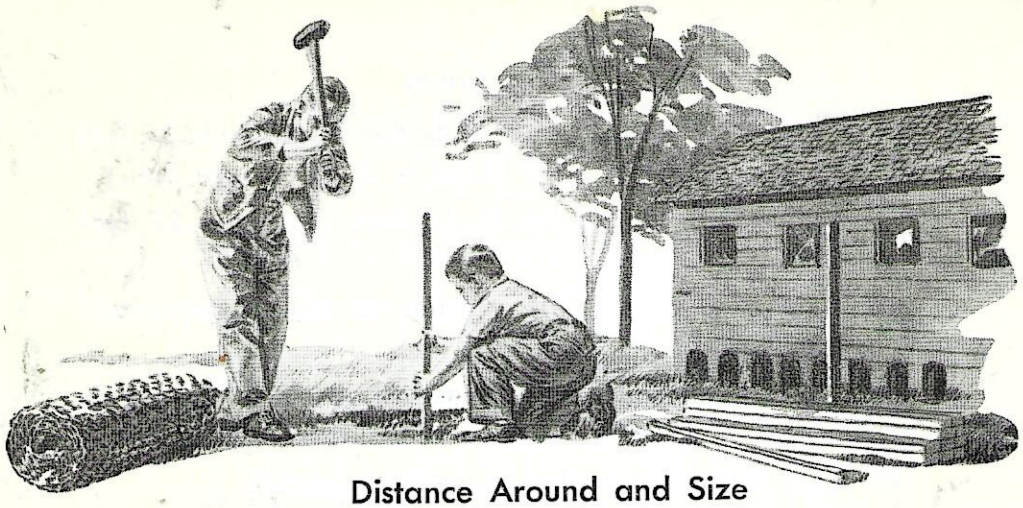
8. The floor of the fifth-grade room in the Webster School measures 33 feet long and 24 feet wide. How large is it in square feet? How large is it in square yards?

9. Measure the length and width of your school room in feet. Find how large it is in square feet.

10. The size of the Webster School lot is 300 feet wide and 360 feet from front to back. What is its area in square feet?

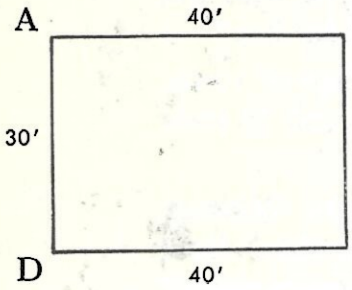
11. Measure the length and width of your school lot. Find its area in square feet.

12. Mr. Bell wants to lay a new sidewalk 4 feet wide and 54 feet long. Find the cost at $3.25 a square yard.



Distance Around and Size

1. Steve and his father marked off a space for a chicken yard by driving stakes at the four corners.



They staked off a space 40 feet long and 30 feet wide. Steve's father asked him two questions:

a. How big is the chicken yard in square feet?

b. How long must the fence be to go around the chicken yard?

This is the way Steve found the area:	*This is the way Steve found the distance around it:*	
40	From A to B	40 ft.
30	From B to C	30 ft.
1200 sq. ft.	From C to D	40 ft.
	From D to A	30 ft.
		140 ft.

2. Here is another way to find the distance around it:

40 ft.	30 ft.	80 ft.
2	2	60 ft.
80 ft.	60 ft.	140 ft.

3. Can you think of another way?

Distance Around and Size

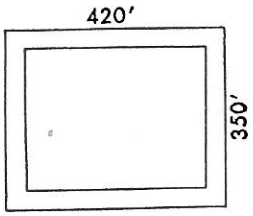
1. Steve was papering his room which is 14 feet long and 12 feet wide. He needed a strip of border to go around the walls at the edges next to the ceiling. How long a strip did he need?

2. How large is Steve's room in square feet?

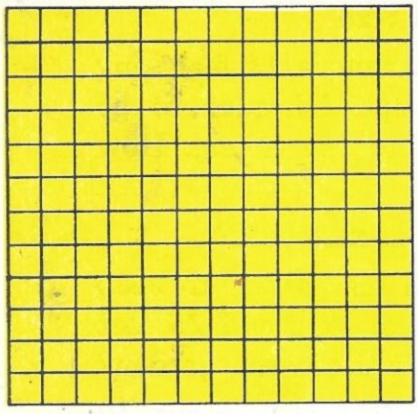
3. Mr. Leach built a fence around his garden to keep the rabbits out. His garden is 100 feet long and 75 feet wide. How long is the fence? How large is the garden?

4. A farmer had a field that was 40 rods long and 40 rods wide. How large was his field in square rods? How long was the fence around it?

5. For exercise Sue and Martha walked around their block 4 times. Their block is 420 feet long and 350 feet wide. How far did they walk?



6. James was building a pen for his rabbits. He was putting up a fence of chicken wire. He wanted the pen to be 20 feet long and 12 feet wide. How many feet of chicken wire did he need?



Square Inches in a Square Foot

1. How many square inches are there in 1 square foot?

A square foot is a square 1 foot long and 1 foot wide, or 12 inches long and 12 inches wide.

$$\begin{array}{r} 12 \rightarrow \text{number of inches long} \\ \times\ 12 \rightarrow \text{number of inches wide} \\ \hline 24 \\ 12 \\ \hline 144 \rightarrow \text{number of square inches} \end{array}$$

12 in. = 1 ft. **144 sq. in. = 1 sq. ft.**

2. How many square feet are there in 1 square yard?

3 ft. = 1 yd. **9 sq. ft. = 1 sq. yd.**

3. How many square inches are there in 9 square feet? How many square inches are there in 1 square yard?

4. Find the area of a window whose shape is a rectangle, 36 inches long and 12 inches wide.

5. Measure the length and the width of the top of your desk to the nearest inch and find its area.

Study these tables. Is the table of square measure correct? How can you tell?

Length		*Square Measure*	
12 in.	= 1 ft.	144 sq. in.	= 1 sq. ft.
3 ft.	= 1 yd.	9 sq. ft.	= 1 sq. yd.
$5\frac{1}{2}$ yd.	= 1 rd.	$30\frac{1}{4}$ sq. yd.	= 1 sq. rd.
$16\frac{1}{2}$ ft.	= 1 rd.	$272\frac{1}{4}$ sq. ft.	= 1 sq. rd.

Area and Perimeter

1. Jack has a garden 18 ft. long and 15 ft. wide. Henry's garden is 20 ft. long and 12 ft. wide. Which garden has the greater area? How many more square feet are in the larger garden than in the smaller one?

2. Dan wants to put a fence around his garden, which is 14 ft. long and 14 ft. wide. The wire for the fence costs 27¢ a foot. How much must Dan pay for the wire?

3. The floor of Mary's room is 10 ft. long and 9 ft. wide. She wants a rug that will be 6 in. from each wall. What will be the area of the rug?

4. Mr. Jones wants to have a new cement floor put in his garage. At 25¢ a square foot what will the floor cost if it is 16 ft. long and 12 ft. wide?

5. Which room has the larger area, one 12 ft. long and 8 ft. wide, or one 16 ft. long and 6 ft. wide?

6. Mrs. Elder wants to have her 9′ × 12′ rug cleaned. What will it cost if the cleaners charge 15¢ a square foot?

7. The boys' club room is 14 ft. long and 11 ft. wide. What is the perimeter of the floor? What is its area?

8. Susan made a rug that is 6 ft. long and $4\frac{1}{2}$ ft. wide. She wants to buy fringe to put all around it. How much fringe will she have to buy?

9. Mr. Walters plants his rosebushes so that each bush has 4 sq. ft. of ground. His rose bed is 15 ft. long and 3 ft. wide. Is the bed large enough for 9 bushes?

10. Martha's room is 14 ft. long and 8 ft. wide. What is the perimeter of her room? the area?

Problem Test

1. Martha bought 24 tulip bulbs. If she plants 6 bulbs in each flowerpot, how many flowerpots will she need?

2. At 75¢ each, what should Mrs. West pay for 3 violet plants?

3. Jane had 63 books in her library. She gave 19 of them to her cousin. How many books were in Jane's library then?

4. Bill went fishing four days last week. He caught 8 fish one day, 6, 10, and 4 on other days. In all how many fish did Bill catch last week?

5. One Saturday the Scouts walked 8 mi. On other Saturdays they walked 5 mi., 4 mi., and 7 mi. What was the average distance that the Scouts hiked?

6. Jim picked 36 lb. of walnuts. He sold one third of them and kept the rest. How many pounds did he keep?

7. Jack had $3.56. He bought a bucket for 85¢ and a sponge for 39¢ so that he could start a business of car washing. How much money had he left?

8. Ted picked 32 qt. of strawberries one day and sold all but 7 qt. of them. How much did he get for the berries if he sold them at 24¢ a quart?

9. Helen has 12 boxes, all the same size, to wrap for the grab bag at the carnival. She plans to use about 10 feet of ribbon to tie up each box. At 3¢ a yard, how much will the ribbon cost?

10. Twelve of the fifth-grade pupils had a party for the class. For refreshments they bought 36 ice-cream cups at 5¢ each. If the 12 pupils shared this expense equally, what did each one pay?

Test on Fundamentals

Watch what you are told to do. Check each example.

1. Add:
$$\begin{array}{r} 269 \\ 377 \\ 486 \\ \hline \end{array}$$

2. Subtract:
$$\begin{array}{r} 837 \\ 105 \\ \hline \end{array}$$

3. Multiply:
$$\begin{array}{r} 48 \\ 65 \\ \hline \end{array}$$

4. Subtract:
$$\begin{array}{r} 1000 \\ 460 \\ \hline \end{array}$$

5. Add:
$$\begin{array}{r} 8\frac{2}{3} \\ 2\frac{1}{6} \\ \hline \end{array}$$

6. 372×84

7. $50.4 - 29.8$

8. $4\frac{5}{8} - 2\frac{1}{8}$

9. $43.72 + 19.56$

10. $36\overline{)1224}$

11. $\frac{3}{5} + \frac{1}{2}$

12. $\$6.95 \times 34$

13. 7.8×8

14. Add $\frac{2}{3}$, $\frac{1}{4}$, $\frac{5}{6}$

15. $17\overline{)816}$

16. $5\frac{1}{3} - 1\frac{3}{4}$

17. 109×83

18. $67\overline{)\$270.01}$

19. $45\overline{)4095}$

20. $9\overline{)37.8}$

21. 12.8×7

22. $9 - 3\frac{3}{5}$

23. $\$15.04 - 7.98$

24. 24.3×36

25. $\$.64 + .08 + .73$

Test on Vocabulary

$12\overline{)84}$ $\quad$ 37×4 $\quad$ $18 + 43$ $\quad$ $\$3.45 - 1.27$ $\quad$ $\frac{4}{8}$ $\quad$ $\frac{6}{5}$ $\quad$ $3\frac{1}{2}$ $\quad$ 8.02 $\quad$ .9

$37 \times 4 = 148$ $\quad$ $18 + 43 = 61$ $\quad$ $\$3.45 - 1.27 = \$2.18$

Match a number from these examples with one of the words below:

a. Sum
b. Difference
c. Product
d. Quotient
e. Divisor
f. Fraction
g. Numerator
h. Denominator
i. Decimal
j. Tenths
k. Mixed number
l. Improper fraction

TABLES OF MEASURES

Liquid Measure

2 cups = 1 pint (pt.)
2 pints = 1 quart (qt.)
4 quarts = 1 gallon (gal.)

Dry Measure

2 pints = 1 quart (qt.)
8 quarts = 1 peck (pk.)
4 pecks = 1 bushel (bu.)

Measures of Weight

16 ounces (oz.) = 1 pound (lb.)
2000 pounds = 1 ton (T.)
2240 pounds = 1 long ton

Measures in Counting

12 things = 1 dozen (doz.)
12 dozen = 1 gross
144 things = 1 gross

Measures of Length

12 inches (in.) = 1 foot (ft.)
3 feet = 1 yard (yd.)
36 inches = 1 yard
$5\frac{1}{2}$ yards = 1 rod (rd.)
$16\frac{1}{2}$ feet = 1 rod
5280 feet = 1 mile (mi.)
1760 yards = 1 mile
320 rods = 1 mile

Measures of Time

60 seconds (sec.) = 1 minute (min.)
60 minutes = 1 hour (hr.)
24 hours = 1 day
7 days = 1 week
52 weeks = 1 year (yr.)
12 months = 1 year
365 days = 1 year
366 days = 1 leap year
10 years = 1 decade
100 years = 1 century

Square Measure

144 square inches (sq. in.) = 1 square foot (sq. ft.)
9 square feet = 1 square yard (sq. yd.)
$30\frac{1}{4}$ square yards = 1 square rod (sq. rd.)
$272\frac{1}{4}$ square feet = 1 square rod

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